1989

Aqua Farm News Volume 07(03-04) May - June & July - August 1989

Aquaculture Department, Southeast Asian Fisheries Development Center

AQUA FARM NEWS

ISSN 0116-6573

Produced by the Publications Section
Information Division, SEAFDEC Aquaculture Department
as a production aid for fish farmers and extension workers

Vol. VII Nos. 3 & 4
May–June & July–August 1989

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SEAFDEC "Better life through aquaculture"

Aqua Farm News is published bimonthly by the
Publications Section
Aquaculture Department
Southeast Asian Fisheries Development Center
P.O. Box 256, Iloilo City, Philippines

ISSN 0116-6573

Subscription rates:

Local – P40.00 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.**

AQUACULTURE – FOR GENUINE DEVELOPMENT?

Item One: Aquaculture Development and the International Division of Labor

The framework of development of aquaculture ("the blue revolution") in the Philippines falls squarely within the scheme of the international division of labor. In the scheme of international trade, aquaculture farms produce the primary products needed by developed consumer markets. Development of sectors other than the primary industry is neglected, since the economy devotes its resources to the production of such primary products. Thus, the development of aquaculture in the Philippines is an important element of the export-oriented growth strategy which purports to exploit the comparative advantage of the Philippines in primary products.

As a neocolony, the Philippines was assigned the role of producing primary agricultural products such as sugar, logs and timber, pineapple, ores, and the like for use and processing in foreign industrial markets. Such traditional role persists in the development of the aquaculture industry. The Philippines, along with other countries like Indonesia and Taiwan, was assigned the role of producing prawns, shrimps, and other primary marine exports. The allocation of local productive resources (cheap labor, land, capital) emphasizes the continuation of such traditional role. It is in this context that aquaculture farms are mainly located in Third World countries. The economy allocates resources toward the production of agro– and aqua–based commodities needed by the foreign markets. The needs of the domestic markets are not emphasized.

There are extensive forward and backward linkages in the aquaculture industry. Most capital inputs are still imported – pumps, aerators, and raw materials for feeds (fish meal, shrimp meal, soybean meal). The requirements for trading services are also extensive – transport, storage, financial intermediation (credit), and the like. These linkages require foreign capital infusion. This is where the unfavorable terms of trade associated with the insertion of foreign intermediation services are high, while prawn and shrimp prices in the export markets are relatively cheap. Under this arrangement, the Philippines is further integrated into the losing end of the global supermarket.

There is no doubt that the development of aquaculture brings in tangible benefits as a whole. However, certain negative aspects are associated with its growth. Such drawbacks indicate that the current thrusts of aquaculture development do not systematically take into account the criteria for social development. Such criteria may include, but is not limited to, the following: that aquaculture contributes to the alleviation of poverty, generation of employment opportunities, and in general, the improvement in the standards of living in the communities where the aquaculture farms are located.

So far, the most pronounced reported drawback associated with the establishment of aquaculture farms involves the displacement and further marginalization of small-scale peasants and fishermen in the communities where these farms are established. There are other social costs: disturbance of the ecological equilibrium with negative effects upon the environment, and the export reorientation of the domestic market previously self-sustaining in terms of marine-based food products. The latter is manifested in the conversion of milkfish and tilapia ponds into prawn farms. Milkfish and tilapia are aquaculture products which previously catered exclusively to the domestic market. Such

pond conversions resulted in a smaller supply of milkfish and tilapia. Thus the price of milkfish and tilapia increased significantly in the domestic markets. The export reorientation of aquaculture development therefore meant more prawns for the U.S. and Japanese market, but less food for the Philippine consumers.

Item Two: Panay Island – An Aquaculture Laboratory

The hospitable topography and rich aquatic resources of Panay Island qualify the area for exploitation of its aquatic potential. The Visayas Sea in Northeast Panay is one of the richest fishing grounds in the country. The island's coastline is also a rich breeding ground for milkfish, shrimps, and prawns.

Currently, national and international capitalist investors, reinforced by financing institutions such as the Asian Development Bank are mobilizing more of their resources to take advantage and extract surplus from Panay aquaculture. These efforts resulted in the close integration of the prawn industry in Panay with international business. Integration, however, meant a strong dependency relationship of local prawn production with market demand from the developed countries. Semi-feudal relations of production in Panay enable the aquaculture industry in the area to be inserted into the sphere of dependency relations with the developed industrial consumer market.

Big business interests, both local and foreign, race among themselves to fully exploit Panay's aquaculture resources. These companies including national food conglomerates link themselves with local prawn farm owners through various subcontracting and domestic trading arrangements. In turn, these companies are linked with international investors through financing and trading arrangements.

Panay's rich natural resources is the magnet which attracts foreign business. In their entry, big business interests create dependency relations wherein the foreign capitalist is assured of a positive surplus in the exploitation of the island's resources.

Item Three: Benefits of Aquaculture do not Trickle down into the Grassroots

Funded by the World Council of Churches, the Panay Self-Reliance Institute (PANSRI), a non-profit, non-stock service organization, undertook an analysis of the development of the aquaculture industry in Panay. The study focused on aquaculture's impact upon the life of the people in the communities where the prawn farms are loca-

ted: Bgy. Lubok in the municipality of Lapuz in Iloilo and Bgy. Maninang in the municipality of Sapian in Capiz. The objective is to provide a basis for genuine, people-oriented development program for aquaculture in the area.

The case study documents the major finding that the benefits of aquaculture in Panay do not trickle down into the living standards of the grassroots. There are even negative effects on employment, wages and incomes of the workers in the farms and on the domestic market as well. There are social costs being borne by the community in terms of displacement and further marginalization of small-scale fishermen. Most urgent among the drawbacks is the disturbance of the ecological equilibrium: changing salinity of the arable area, lowering of water levels, and other environmental costs - pollution of the estuarine and mangrove areas by organic chemicals used in prawn farms.

The following statements are a synthesis of the comments made by workers and community residents in response to the question: "Who benefits from the aquaculture industry?"

"Traders who export prawns greatly benefit from the industry, as well as their foreign partners. Foreign consumers benefit from the cheap prawns being sold to them."

"Corporations and their owners benefit - such as Shoemart, Purefoods, and San Miguel Corporation. (The latter two are the biggest food conglomerates . . . engaged in production and trading in prawns for export to Japan and other countries.)"

"The economy benefits as a whole, since foreign exchange earnings are generated from the prawn exports."

"The local government gets revenues from prawn farms who pay business taxes. The national government derives tax revenues from prawn exports."

"Merchants/traders of prawn farm inputs also benefit." (In the area, Chinese businessmen have control over the trading and marketing of raw materials used in prawn production.)

In their statements, the respondents (total = 106) were consistent in their perception that it is largely the prawn farm owners and the traders who mostly benefit from the aquaculture industry. Only a minority of respondents included workers employed in the farms in their list of who benefits from the industry. The pattern of responses indicates that workers and community residents derive few benefits, if none altogether, from the industry. The respondents pointed out that it is the prawn farm, or company (not they as workers) who benefit.

Perceptions of respondents on the effect of aquaculture upon village life

	Positive Effect	*Negative Effect*	*No Effect*
Employment	17%	30%	53%
Income	20	31	49
Standard of living	9	51	40
Health	10	58	32

Distribution of respondents by province and by perception of the effect of the prawn farms on their living standards

	Iloilo Village	*Capiz Village*
No Effect	43	9
Positive Effect	2	19
Negative Effect	5	28
	50	56

Chi-Square: 51.85 (Highly significant)

Distribution of respondents by income level and perception on the effect of the prawn farms upon their living standards

Income Level (monthly)	*No Effect*	*Positive*	*Negative*
Less than P500	4	0	1
P 500–P 999	9	0	16
P1,000–P1,999	17	3	28
P2,000–P2,999	7	1	4
P3,000 and above	6	3	4
	43	7	53

Chi-Square: 14.449 (Highly significant)
Probability: 0.0708

Item Four: PANSRI Recommendations

Short of a genuine structural transformation in the political economy of the Panay Island (and the Philippines), the Panay Self-Reliance Institute put forward these recommendations consolidated from the views of the respondents, community organizers, and committed development workers in the aquaculture areas in Panay:

1. Prawn farm workers need to be organized, for them to be able to bargain better for additional wages and benefits. Government must monitor compliance with wage and other labor standards in this sector.

2. Health and safety standards, especially in terms of sanitation, must be given attention. Even a water supply system for the use of workers in the prawn farms does not exist.

3. Prawn workers need alternative forms of employment. Provision must be made for a system of advanced skills training and accreditation of on-the-job experience. Migration of non-local workers has given rise to social tensions, and residents feel that local workers must be given priority in employment or placement especially for low-skilled jobs.

4. Cooperatives must be encouraged, which could be sources of credit in order for

small fishermen to acquire means of production (i.e., own small fishing boats). Soft loans are needed from the rural banking sector, and government policy must encourage and even guarantee such soft loans. This would require government subsidy as well as other infrastructure support for marketing, storage and processing facilities. Marketing cooperatives for small-scale traders serving the domestic market must be supported by such schemes as a consignment arrangement.

5. Small fishermen need assistance to enable them to form cooperatives as prawn producers. Access to credit such as soft loans with a minimum of collateral is a priority for them. Agrarian reform must be implemented in big-sized prawn farms. There is, however, great resistance among the big landowners of Panay to the idea of extending land reform even among prawn farms. In fact, there is a well-organized landowners' group in Panay Island which aims to block agrarian reform in the area. To prevent social unrest especially among the peasants and the small fishermen, they have supported the militarization of various areas of the island.

6. Grassroot organizations of marginal fish producers need to be strengthened. The various organizations of small fishermen must get together to influence local government officials to provide support services. One urgent area of democratization of resources is to grant priority to small fishermen's cooperatives in terms of access to concessions. Government policy on aquatic resources, such as grant of concessions, must prioritize and favor the small-scale producers.

7. The entry of new technology in prawn production may, at the same time, encourage dependent linkages on the foreign sources of such technology. There must be a policy to nationalize the technology being used in prawn farm production. Import-dependent linkages must be minimized. For instance, farm owners still procure imported equipment and machines when these could be assembled or even manufactured locally.

8. Prices of prawn are vulnerable to low fluctuations during peak harvest seasons. Some form of a commodity futures market must be examined for applicability in the area, to facilitate trading and to force the prawn farm owners to improve their production planning.

9. It is urgent that the national agency concerned with pollution control formulate regulations with respect to the use of aquaculture chemicals in relation to environmental protection. Local governments must be informed of the relationship between aquaculture chemicals and environmental pollution, and local officials must formulate ordinances in this respect. In particular, construction of additional fishponds along mangrove areas must be stopped. These areas must be protected, to perserve the estuarine ecological system in the same manner that Palawan province has been declared to be a mangrove and coral reef reserve area.

10. The fisheries and aquaculture industry must be protected to prevent massive depletion of the natural resources of the country and to protect Filipino small fishermen from undue competition. Legislation in this regard must be enacted.

Source of Items One, Two, Three & Four: *Political Economy of Aquaculture in Panay (Philippines)* by the Panay Self-Reliance Institute (PANSRI) (Research Team: Maragtas S.V. Amante, Fatima V. Castillo, Lorna Z. Segovia), March 1989.

Item Five: Criteria for Funding Aquaculture Development Projects

Aquaculture has become very popular among developing nations as a solution to problems of low income, inadequate hard currency to pay international bank debts, insufficient food and malnutrition. Hundreds of millions of dollars are being invested in aid, tied and untied, for aquaculture. The shrimp culture industry already has grown into a multi-billion dollar giant. Numerous conferences on aquaculture are held every year and large numbers of books and manuals are being published. Considerable expertise and funds are being devoted to aquaculture research.

But does aquaculture always supply the appropriate solution to poverty and malnutrition?

Does it tend to increase the income of the middle and upper classes, instead of the poor?

Does it improve nutrition over wild-caught and gleaned marine resources?

Is the cost of cultured fish too high for the poor?

How much of the harvest is exported to well-to-do countries?

How much naturally productive environment is displaced by aquaculture?

Would the funding be better spent on restoring the natural environment?

How much of the benefits flow to the food and aquaculture industries of developed countries?

Have independent environmental assessments of the impact of the aquaculture project been made?

Automatic approval and promotion of aquaculture for developing countries are thus questioned. At times aquaculture may be appropriate, may be inappropriate, or, may be of uncertain benefit to developing countries.

To evaluate whether a given aquaculture project is appropriate, the criteria listed below are based on the assumption that the development project aid is aimed primarily at providing long-term benefits for the poor– income, quality of life, good health, etc. – and that appropriate aid should little disturb the diversity, productivity and beauty of the natural environment. It is the overall quality of life, not just dollars, health, etc. that is in question.

CRITERIA	**YES** *(Favorable Project)*	**NO** *(Less favorable or unfavorable project)*
SOCIAL		
Whose income does it benefit?	Poor	Middle class, rich
Capital needed	Low capital	Capital intensive
Return to worker/family	Self-employment	Low wages
Operated by	Individual, family co-op or community	Company
Gender	Benefits men, women & children	Exploits/neglects women & children
Disturbance to culture, customs	None	Some, much

Working conditions – – capture fishery or gleaning	High quality	Low quality
Nutritional quality – natural food	Equal to or greater than	Lower than
Food for	Poor	Wealthy
Effect on public health (drinking water, mosquitoes, parasites, etc.)	Low	High
Who made the decision?	Local community after mature debate & discussion	NGO, Washington, London, Ottawa, consulting company
ENVIRONMENT		
Culture method	Polyculture	Monoculture
Relation to natural environment	Displaces none or little	Replaces one with another
Used as an excuse not to restore natural environment or uses restoration funding	Not so	Is used
Uses few artificial genetic strains	Not so	Is used
Risks escape of selected strains into nature	No	Yes
Cultured stock	Native	Exotic
Risks to native species - disease, hybridization, extinctions, etc.	None	Some, much
Disease, predators, competitors controlled by	Biological means	Chemical means or by drugs
Fertilizers	Organic	Chemical
Output into natural environment – chemical, organic & physical	Low	High
Culture subjectivity to disease/ stress	Low	High
Facility design effect on wildlife predators	Naturally excludes birds & mammals	Fish-eating ducks, herons, cormorants otters, seals, etc. controlled by gun
AESTHETICS		
Culture area	Beautiful	Ugly
WORLD ORDER		
Produces food for	Third World	Developed countries
Profit flow ratio	High for Third World	High for developed countries
Needed supplies & most goods from	Third World	Developed countries
Import of foreign technology	None	Some, much
Needed 'seed' stock from	Third World	Developed countries

The above table can be used to analyze projects proposed for funding, compare projects, select projects, or enhance project design. A few criteria are discussed below as the intent of most is obvious.

Polyculture may offer more ecological and economic stability than monoculture. Culturing two species of fishes plus shrimp in an existing rice paddy means no additional land is impacted, diversity and production is enhanced, and the animals fertilize the rice.

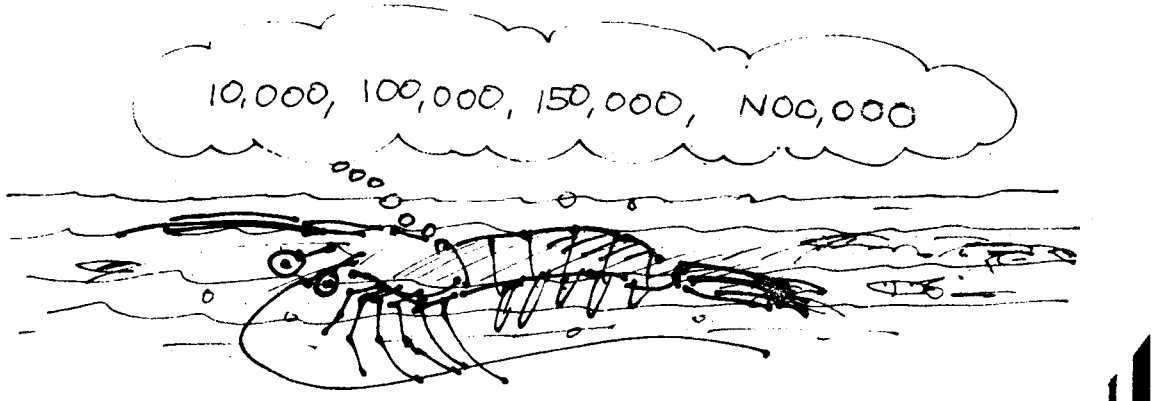
Productive coral reefs, mangroves or estuaries should not be displaced by aquaculture ponds and traditional small-scale fisheries and gleaning should not be displaced by entrepreneurs. Even if productivity of these environments has deteriorated, consideration should be given to the possibility of restoration or reforestation before aquaculture ventures are instituted. Even if funding has been decided for an aquaculture project, funds should be added to, not diverted from, environmental restoration.

The introduction of exotic species for aquaculture carries complex long-term risks and should not be done without funding in-depth impact studies. Predicting the complex effects of such releases is at the limits of today's biological knowledge. It should be assumed that exotic species will escape into the wild. Will this cause local species extinctions? Will burgeoning escapee populations modify the environment? What are the economic and social consequences? Nile perch and new fishing gear are implicated in the loss of populations of African cichlids in Great Rift lakes. Mosquitofish introductions have driven native species to extinction. The escape of an exotic shrimp in Kunming, China has endangered an endemic species. Consider cultivating native species instead. South America has for example many native cichlids and there is no need to introduce African species. Plans to introduce planktivorous clupeoids into African lakes lacking them are risky. There are already cichlids which consume plankton in these lakes and most larval cichlids consume plankton.

Aquaculture offers many benefits to Third World countries. But the overall effects on society and environment should be weighed before individual projects are supported.

Source: Don E. McAllister, "Aquaculture, Yes, No, Maybe?," **Sea Wind**, Vol. 3, No. 1, January-March 1989.

Item Six: How Far Can Intensification Go?



As the Taiwanese developed "better and more sophisticated" technology, their production grew so rapidly it was projected that from some 10,000 hectares of farms production would reach 100,000 metric tons by 1988. This would have put them at par

with China where an estimated 100,000 hectares of prawn farms were in production. But the anticipated record production *failed* to materialize. Taiwan's production for 1988 was estimated to have "at best" reached only 50,000 mt, half of the projected output. Taiwanese farmers, who normally incur higher production costs than their Asian counterparts, were beset with mortality problems and suffered heavy losses. Thus, in what has been described as "the worst year for Taiwanese (prawn) farms," prawn farmers everywhere took a long, hard second look at the once seemingly endless promise of the Taiwanese high-density method – what went wrong?

During their best years, Taiwanese farms, using an average stocking density of 340,000 per hectare were producing 11,000 kg per hectare per year on the average. The high densities employed meant that farms were energy-intensive, needing artificial aeration, and water exchange. At the stocking rates used, it was also surmised that the risk of disease was correspondingly high. The application of supplemental feeds, chemicals and antibiotics, as well as "good management practices" such as adequate pond preparation, good water management, and close monitoring throughout the various grow-out stages, might have initially checked the incidence of disease. Increased production costs resulting from the need to control diseases were offset in part by high demand and good prices for prawn abroad.

Eventually, however, these measures might not have been enough. In 1987, scientists at SEAFDEC AQD warned of the "consequences of Taiwan's high-density prawn farming." In a memo for SEAFDEC AQD Chief Flor Lacanilao, which was later passed on to Agriculture Secretary Carlos G. Dominguez, SEAFDEC scientist Jurgenne H. Primavera noted that the "occurrence of disease (rot disease, blue prawn, tail rot, etc.) and unmitigated use of chemicals and antibiotics (in Taiwan) have led to resistance of disease-causing organisms and could cause a slump in Taiwan's prawn production in the next two to three years." By October 1988, Taiwan's prawn production was reported to have gone down "dramatically" due to "a variety of climatological and technical reasons," a succinct but incomplete explanation.

Intensification advocates were disappointed, but Taiwan's crop failure last year was nonetheless expected. For years, aquaculture experts knew of the costs and attendant risks of high intensification. Not a few cautioned against it – overcrowding, they said, result in "environmental stress" which in turn weakens the prawn, making them more susceptible to diseases.

Explained D.F. Fegan of Tri-Jade Aquaculture Corporation (*Aquaculture Watch*, March 1988):

"Disease occurs because the prawn are already stressed by other factors, thus reducing their resistance. To give an analogy, up to 60 percent of humans carry the *Herpes* virus which causes cold sores around the mouth. This does not mean that 60 percent of the population have cold sores. The virus usually lies dormant, kept in check by the body. At times of emotional or physical stress, however, the virus becomes virulent and causes a sore to develop.

"So it is with many prawn diseases. Most of the common disease-causing organisms are normal constituents of the body flora or environment of the prawn. When the prawn is stressed, these organisms may grow unchecked and result in disease.

"Little is known about specific diseases. What is certain is that disease occurrence becomes more widespread as stocking rates and levels of intensification increase."

Experienced prawn growers have long been cognizant of the risks experts speak of – they have seen intensive operations fail only too often. But, until 1988, a great number of them had always had something to blame for the crop failures – poor water management, inadequate pond preparation, low-quality feeds, weak fry, etc. For as long as the Taiwanese were harvesting good crops, the method "worked." If a farmer failed, everything but the stocking density is blamed.

Year '88 gave prawn growers reason to take a kinder view on their past failures with intensification. Taiwan's experience last year showed the limits of the high-density method. As yet, there is no affordable technology available that can effectively manage all the problems associated with very high stocking densities. Chemicals and antibiotics – today's answers to prawn disease – can solve the problem only up to a certain point; they do not remove the underlying cause of disease which is the environmental stress brought by intensification itself.

In Sri Lanka, a mortality problem hit the shrimp farming industry last year, reported *Trans Asia News Service* (*Aquaculture Digest*, January 1989). The report said many farms were affected but the company Lever Brothers was "hit hard" because it operates "the most *intensive* farm in Sri Lanka. Marine Culture Enterprises, "the *most intensive* (prawn) farm in the world" into which some $10 million in investment was poured, was also hit by a virus and had to close down last year, only two years after it started full-scale operations. (The company has since been sold to Norwegian interests that are preparing to raise tilapia and *Penaeus vannamei* under the name Pacific Sea Farms.) And, in the Philippines, some growers who ventured into intensive operations now speak of having been "burnt," a "painful" learning experience that they say others need not have to go through. Because of the huge capital requirements of intensive operations, they explain, a single crop failure can be devastating.

So what should be the limits of intensification, given the technologies now available?

"SEAFDEC AQD has always recommended semi-intensive – 50,000 per hectare, tidal water only supplemented by pumping with no deep wells – and extensive farming," said Primavera.

While SEAFDEC is primarily concerned with the well-documented ecological and sociological costs of intensive farming, there are also economic considerations behind the promotion of the less intensive shrimp farming methods. Primavera maintained that, contrary to common perception, intensive stocking rates of 200,000-500,000 per hectare are in fact among the least cost-effective levels of intensification now in use. Intensive farms are not only the most capital-intensive and disease-prone, she said, but studies made by SEAFDEC, the University of the Philippines in the Visayas, and the United Nations' Food and Agriculture Organization also show that they do not fare well when export market prices fluctuate. "This is because (intensive farms) operate with a narrow profit margin per volume although they have a high profit margin per area," she explained.

Why then push for 200,000 to 500,000 per hectare with all the costs and problems these stocking rates entail?, Primavera argued. Compared to the higher densities, she

pointed out, stocking rates of 50,000 to 100,000 per hectare are not only "profitable" but also entail "a minimum of disease and quality problems."

Said Fegan: "In the final analysis, with prawns as with humans, prevention is better than cure. Rather than the pursuit of higher stocking levels, higher and more elaborate technology and higher risks, isn't it preferable to accept lower production levels with lower production costs and higher quality of product?"

Source: **Aquaculture Watch** , Vol. 3, No. 1, January 1989.

Item Seven: Social Costs of Intensive Prawn Farming

The social implications of intensive prawn farming include the reduction of domestic and agricultural water supplies, decline in quantity of food fish, marginalization of coastal fishermen, displacement of labor, and credit monopoly by big businessmen.

From Negros Occidental where intensive farms proliferate come reports of drying up of shallow wells and browning of previously green orchards. Such reports have led the columnist of a daily bulletin to predict that pretty soon, the prawns will have all the freshwater and people will be forced to drink seawater. So funny, were it not so sad.

Rice and other agricultural crops are also adversely affected by the drying up of groundwater and saltwater intrusion in coastal areas. The Deputy Director General of the Department of Forestry of Thailand has asked: ". . . how much land has to be spoiled by (prawn) farming and how much rice output has to be reduced?"

Rice, the Filipino and Asian staple, is not the only food commodity affected. Fisheries statistics show that production of the popular milkfish which hit a peak of 252 000 mt in 1982 has progressively declined to only 164 000 mt in 1986. For the most part, the decrease is associated with a decline in Laguna Lake pen culture of milkfish. However, it may also be traced to a shift in pond hectarage from the domestically consumed milkfish to the more lucrative prawn crop. Are we then sacrificing food sufficiency for export dollars?

The depletion of coastal fisheries due to mangrove conversion into ponds and the discharge of prawn culture by-products into adjacent waters further marginalized sustenance fishermen dependent on mangrove areas. The conflict stems from the nature of fishing which is rooted in the communal use of a resource, e.g., mangroves, in contrast with culture which presupposes control over an area through private ownership or lease. The wide array of economic goods and services including materials for fuel, construction, and fishing; food; and shoreline erosion control is no longer available to coastal communities with the decline of mangroves.

Farm workers, too, are displaced. Figures from the National Federation of Sugar Workers show that seven to eight laborers are needed to maintain 5 ha of sugarland in contrast to only three for an intensive prawn culture farm of equal size. Intensive aquaculture with its high capital cost has a poor employment-to-investment ratio. Extensive farms utilizing wild prawn fry benefit numerous fry collectors whereas intensive ponds are dependent on hatchery fry reared in the millions by only a few technicians.

It is unfortunate that the livelihood of our society's small fry – the subsistence fisherfolk and agricultural workers – is endangered rather than enhanced by intensive prawn farming.

The SEAFDEC Aquaculture Department, since the start of its prawn research in 1974 and its training and information dissemination program in 1977, has focused on semi-intensive prawn farming because of the social, ecological and economic trade-offs. Moreover, as an attached agency of the Department of Agriculture, it has to follow the national mandates of social equity and environmental conservation.

Source: J. Honculada-Primavera, "Social, Ecological and Economic Implications of Intensive Prawn Farming," SEAFDEC Asian Aquaculture, Vol. 11, No. 1, March 1989.

Item Eight: Needed – Redirection of Government Fisheries Policies

Some of our development approaches to fish production have caused more harm than good. Only the rich have gained from these ventures. The economic benefits have hardly trickled to improve the living condition of the poor. Moreover, such "development" has degraded the environment. The following examples can be cited:

1. *Development of mangrove swamps into aquaculture sites.* Mangroves provide nutrients and breeding places for many marine fishes and invertebrates. Numerous scientific studies confirm this fact. For instance, studies have shown that for every hectare of mangrove swamps converted to other uses, harvests of fishes and shrimps from coastal waters are reduced by 0.8 to 1.4 tons annually. Land reclamation and fishpond development, however, continue to reduce our mangrove areas. Thus, increasing aquaculture in brackishwater areas in effect lowers the catch of small-scale fishermen.

2. *Intensification of fishpond culture, especially in prawn farming.* This production approach is negated by the occurrence of fish diseases and unwanted environmental impact. To control fish diseases, prawn raisers use antibiotics and other drugs. These chemicals eventually pollute coastal waters and harm marine organisms. A more serious consequence is the development of drug-resistant human pathogens.

3. *Increasing use of agricultural land for prawn farming.* One example of the adverse effect of inland aquaculture is the reported intrusion of saltwater into the underground water supply in Negros Occidental. This results from the overpumping of well water used to dilute seawater to attain required salinity in prawn ponds. Another example is land depression or subsidence in Taiwan where two-storey houses have sunk to become one-storey bungalows due to the same overdrawing of underground water in some areas.

4. *Introduction of pen and cage culture in lakes.* In the early 1960s when there were yet no fishpens in Laguna Lake, annual fish catch was about 80,000 tons. With the introduction of fishpen culture, which occupied one-third of the lake by the early 1980s, open-water fishing yielded only 19,000 tons yearly. Fishpen culture, on the other hand, reaped an annual harvest of 62,000 tons. Combining the two production figures

adds up to 81,000 tons, similar to the 1960s harvest. However, the distribution of benefits favored the big fishpen operators numbering only a few hundreds, in contrast to the more than 10,000 small fishermen dependent on the lake. Note also that cultured fish (without supplemental feeding) and wild stock compete for the same natural food in the lake so that reduction of the fishermen's catch was to be expected.

5. *The use of some commercial fishing gears such as the destructive trawl and muro-ami.* A case study in San Miguel Bay in Bicol showed that 77% of the total profit from the bay fishery went to trawlers owned by only 35 families. Share of the 5100 small-scale fishermen who used traditional fishing gears was less than 15%. Without the trawlers the fish catch of small fishermen would be more and fish habitats would not be destroyed. Such habitats include coral reefs which in excellent condition produce a fish yield of 300 kg/ha/yr.

The above are only some of the "developments" in local fisheries that have succeeded in creating environmental problems and in worsening the plight of the small fishermen. It is therefore not surprising that fish production in the last five years (1983-87) improved by only 30,000 tons or an annual rate of increase of a measly 0.3%, while our population grew at 2.5% each year.

A redirection of development policies toward greater environmental consideration and broader levels of beneficiaries is therefore necessary. This calls for greater emphasis on coastal development, as the government now pursues, involving small-scale fishermen.

Source: "Countryside Development Through Small-Scale Fisheries," paper presented by Dr. F.J. Lacanilao, SEAFDEC AQD Chief, at the Regional Symposium on Coastal Fisheries Conservation and Development, Iloilo City, March 9, 1989.

Item Nine: Looking Beyond Profit

Prawn farms, orchards, and other capital-intensive agribusiness projects generate very little employment. Thus, in the spirit of solidarity and recognizing the harsh fact that the Government is not ready to help millions of small farmers to be more productive, those who earn profits in these ventures exempted from the law's retention limits, must be active in projects that can help the poor farmers around them. For example, individual entrepreneurs or corporations engaged in the various phases of the prawn industry can put up private volunteer organizations (PVOs) that can deliver support services to small farmers.

These PVOs can replicate in their respective regions some of the successful programs of the Philippine Business for Social Progress, Pilipinas Shell Foundation, and the Mother Rose Foundation to help poor farmers. For example, a group of agribusiness entrepreneurs will establish the first Family Farm School in the country. Family farm schools have been successful in France and Spain in training the children of small holders in modern farm practices. Spain and Italy have farmers' cooperatives that can be models for organizing Filipino farmers.

Agribusiness investors who will benefit from a more realistic Comprehensive Agrarian Reform Program (CARP) should heed the exhortation of Pope John Paul II in

his recent social encyclical *Sollicitudo Reis Socialis* (Social Concern) that "A greater responsibility rests on those who have more and can do more." Those who have more than enough to provide for themselves and their families a decent and comfortable life cannot be deaf to the Pope's call: "I wish to ask them to be convinced of the seriousness of the present moment and of each one's individual responsibility, and to implement – by the way they live as individuals and as families, by the use of their resources, by their civic activity, by contributing to economic and political decisions and by personal commitment to national and international undertakings – the *measures* inspired by solidarity and love of preference for the poor."

Source: "Perspectives," **The Manila Chronicle**, April 28, 1988.

RISK MANAGEMENT IN AQUACULTURE

Risk management is defined as "the identification, measurement and economic control of risks that threaten the assets and income of a venture."

Husbandry of the stock must remain the focal point of interest throughout. However, any comprehensive study must examine management of the risks during harvesting, processing, packaging, shipping and marketing of stock.

Knowledge of the comparative level of risk inherent in the business is also useful. On a scale of one to a hundred, it might be said that we know 75% of the biology of human beings, and perhaps we know 50 to 60% of the biology of chickens, cows, pigs and other farm animals. But our knowledge of the aquatic creatures we farm ranges from a minimum of 20% down to 5%. We thus have a good indication of one of the industry's prime risks – the biological one.

Any attempt at uniform identification of risks across the industry encounters the problem of its enormous diversity, e.g., the hazards to trout in Denmark are substantially different from those in Italy. To further complicate the problem, there are differences in risk within the cycle of each species. Thus the hatchery-to-smolt stage of the salmon involves a vastly different set of risks from those of the cage-rearing stage.

But there are also similarities, with a surprising number of aspects of each type of rearing system common from one system to another. Moving water in a controlled way is very common in many systems; so, too, is heating, filtering and sterilizing it. Although aquatic plants and creatures have widely different biological demands, they can still share common needs such as treatment of parasites, treatment with antibiotics, and common water temperatures.

Equally common to all aquacultural operations, regardless of species and their requirements, or even the systems involved, are the perils of the elements – of wind, wave, flood, drought, freezing, and so on.

It is clear that, despite the diversity of the industry, techniques developed for the management of any risk, while they may be related to a particular species or system, may be directly transferable to another species or system. But the risks need to be identified.

For convenience, the various types of risk can be grouped within two main categories – Business Risk and Pure Risk.

Business Risks

1. *Social risks* (changes in consumer tastes or social behavior). It is probable that seafood can gain substantial ground in world food markets through aquaculture. It is equally probable that it can hold that ground. To do so, however, there will have to be considerable expansion of production and an attendant increase in the area of the world's marine and freshwater resources that are taken over for aquaculture. Such an expansion in production could possibly engender social resistance to the take-over by the industry of what is seen by the public as recreational territory.

2. *Economic risks* (inflation, changes in the level of economic activity, the actions of competitors).

3. *Marketing risks* (errors in forecasting demand, loss of markets to competitors). The problem of forecasting demand is a subject for separate discussion, as is the loss of markets which may arise for a substantial number of reasons. However, the high biological risk factor in aquaculture is very relevant to this heading. It is well recognized that, to compete in the market, the fish farm product must arrive in perfect condition. Indeed the flexibility afforded by being able to harvest at the last moment, when a purchaser has been found, is one of the advantages that aquaculture enjoys over traditional fish hunting. The potential for disease to impede growth, or to cause unbalanced growth, is quite substantial. Several sectors of aquaculture have already had to grapple with the problems of unsightly lesions, misshapen product, "muddy" taste, and poor shell-to-meat ratios.

4. *Production risks* (changes in cost, problems in supply of raw materials and services, interruptions in production). Probably the major topics deserving discussion under this heading are, firstly, the supply of juveniles in a rapidly expanding industry, and secondly, the generally scarce resources of biological knowledge which are needed to ensure the success of each venture in the industry. Any business which is founded in circumstances in which the supply of juveniles is very limited, must in effect bear the burden of the risks to the hatchery that supplies it. If the hatchery goes down, and there is no other source of juveniles, then production facilities could lie idle for a long time. Production risks are also greatly increased in a situation where a high level of biological skill is needed but is not available. More often than not, success can be traced to the quality of government back-up or to the availability of a skilled technical back-up provided by universities and other centers of excellence. Much waste in an industry can be eliminated if an active, knowlegeable source of risk management is available to it. Insurance is one of the most effective tools for handling risk. However, such are the production risks of aquaculture that the insurance industry is handling them with great difficulty. Some major production risks are virtually uninsurable. It is still a possibility that the insurance industry may in the future withdraw from covering, or decline to cover, a number of other risks of production.

5. *Political risks* (nationalization, political unrest, war, trade restrictions).

6. *Financial risks* (changes in the availability or cost of credit, bad debts, etc.). The availability of credit could become a problem for the industry. The early successes of the industry have engendered a formidable desire on the part of some banks to lend money on new aquacultural ventures. In many instances, these investments have been based on unsound business plans, formulated on unsound basic assumptions. Around

the world, a number of projects have failed and lending institutions have lost substantial amount of money; more may well follow. Risk management has a great deal to offer banks and other investors. But unless they embrace the concept of risk management and apply it to their investment considerations, they will go on investing in projects which stand no chance of success.

7. *"Business" technical risks* (snags in new processes, lack of knowledge). If we know twice as much of the biology of chickens as we know of the biology of trout, it could be said the risks of growing trout are fundamentally twice as great as those of growing chickens. In fact, because of the "water" element in the trout business, the risks of growing them are even greater; supplying air to chickens is a lot easier than supplying water to trout.

New processes and technologies abound throughout aquaculture; it is impossible to overemphasize the risks associated with them. When combined with a general lack of biological knowledge, they can be debilitating to the aquacultural business venture.

Pure Risks

1. *Physical effects of nature* (windstorm, earthquake, drought, flood. etc.). It is an old, thoroughly proven, adage in the aquacultural insurance market that "if you want to find out about the extremes of nature in a particular place, then put a fish farm there." At every stage of the production cycle, aquaculture has to manage the risks associated with water, and with all the physical effects of nature.

2. *"Pure" technical risks* (the breakdown of plant, failure of safety devices, hazardous processes going wrong).

Alarm systems tend tc be seen as a panacea for all the risks associated with controlled-flow (intensive) farms. Four things have to be understood about alarm systems:

- They don't always work.
- Each one can only monitor a very limited part of a site.
- They are only as effective as the response time and knowledgeability of the staff, measured against the tolerance of the species, as related to the situation concerned.
- They can engender an unwarranted feeling of security which can directly cause losses.

There are many examples, too numerous to detail, where alarms have failed to function, or where they have functioned but there has been nobody to respond, or where they have functioned but the response has been ill-equipped to handle the situation.

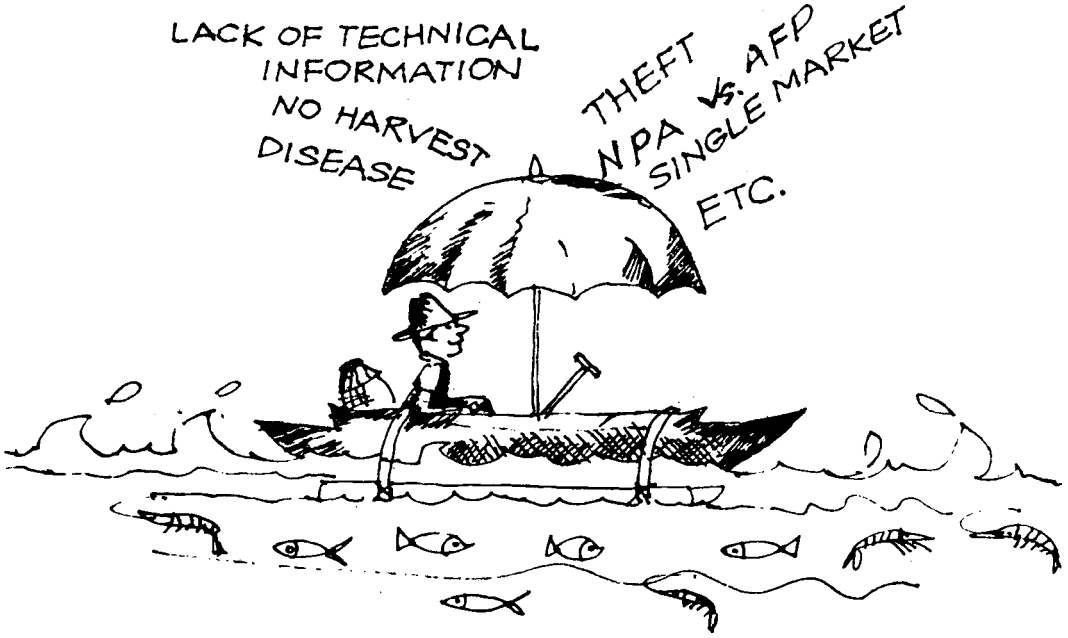
The relevance of pure, technical risks varies according to the type of growing system involved. However, there is no doubt that the breakdown of plant and the failure of safety devices afford one of the most fruitful areas for risk management investigation.

3. *Deviations from expected standards of social conduct* (theft, fraud, riot, sabotage, malicious damage, etc.)

4. *Liability* (hostile legal action from clients, employees, the public). It only needs one careless producer to sell one infected fish for the image of the industry in a whole country, or even wider afield, to be blackened. The liability exposure is one thing, but consequent effect on markets could be devastating. It has happened in the canning industry; it could happen in aquaculture.

Some areas of *liability* to be watched are:

- Liability of the vendor of fish for the transfer of diseases to the purchaser, to his site, and his other stock. (There is no such thing as "Disease Free" in aquaculture!)
- Liability for environmental damage by fish farms.
- Liability of system designers (and builders!) whose system do not come up to standards of performance promised.
- Liability of equipment manufacturers, as in the preceding.
- Liability of others for polluting fish farms.
- Liability to the general public.
- Liability to employees.



"A certain proportion of risk to the aquaculture venture is site-related and therefore a prerequisite to measuring the risks in individual operations is a large amount of information on each particular venture and on the site(s) it operates." That is a statement related to measuring risk at a very basic and isolated level. The risk exposures to individual sites can be intelligently estimated if an appropriate amount of information is available.

There is a need to coordinate all kinds of *risk-related information* of which the following are general examples:

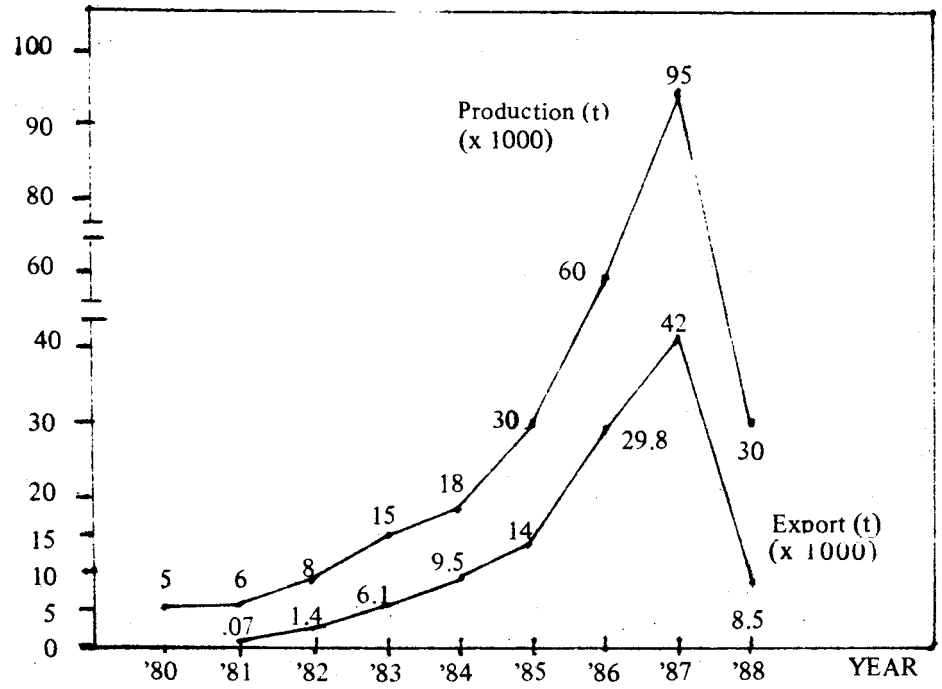
- The average and the extreme effects of various catastrophic and sub-catastrophic diseases.
- The average and extremes of various environmental factors such as droughts, hot cycles, cold cycles, floods, etc.
- The basic parameters for mooring cages and rafts in the marine environment.

- The incidence of plankton blooms, their make-up, the circumstances in which they occur, the extent of the area they cover, and the way in which they can be handled.
- Advisable stocking densities.
- Acceptable alarm systems.
- The efficacy of vaccines.
- Working conditions in aquaculture.

The list will prove to be a long one. But the compiling of risk management priorities in aquaculture urgently needs to be undertaken. Such a priority task deserves the immediate attention of the leading authorities in the industry.

Source: P.A.D. Secretan, "Risk management in Aquaculture," *Fish Farming International*, Vol. 15, No. 2, February 1988.

ANATOMY OF THE PRAWN INDUSTRY IN CRISIS: TAIWAN EXPRIENCE



Prawn Crash of '88: Taiwan. (Data from I-C. Liao, Int. J. Aq. Fish. Technol. 1(1), 1989)

The steady, uninterrupted growth of the industry over two decades was capped by a tremendous output of 95,000 t in 1987. The sudden drop of production volume to 30,000 t in 1988 came unexpectedly, and for a while remained a puzzle to many observers in other countries who were following closely the development of Taiwan's prawn culture industry. Actually, though, as early as 1987, the local scientists were already noticing some scattered signs of an impending crisis, but by the time, there was practi-

cally no way of stopping it. The following year, when the crisis did occur, Taiwan's scientific community had to work hard to be able to put together a more complete logical picture of what had precipitated it, and a workable plan for dealing with it.

A special task force called "Fish Disease Prevention Working Group" was formed to investigate the probable causes of the mass mortality that hit the *P. monodon* farms, and draw up a report to the government and to the public, as well as a set of recommendations, within a three-month period beginning May 1988. Biology scholars and aquaculture specialists from *Academia Sinica* and from various universities and research institutes were called upon to be members of the working group.

Taiwan Fisheries Research Station branch laboratories provided technical assistance and administrative support to the group in the conduct of studies and investigations. The group's tasks included the following: surveys on water temperature and water quality in hatcheries and ponds; chemical analyses on larval feeds; culture of healthy seedstock; devising of methods for identifying viral diseases; and production of virus-free broodstock for release into the sea in order to replenish the dwindling supply.

The data gathered by the group indicated that the southern area of Taiwan was the hardest hit by the crisis, the mortality rate there being about 70%. Mortality rate in central Taiwan was 60%, and in the north, 40-50%. The mass mortality began in the south and was observed in the central and northern areas after a while, but the time lag was attributed to differences in the ambient temperatures (from the south to the north), and not to contagiousness of the diseases.

WHAT WENT WRONG

A report of the group's findings divided the reasons for the crisis into two main categories: non-pathogenic factors and pathogenic factors.

Non-Pathogenic Factors

Use of high temperatures to accelerate larval growth. The ideal range of water temperature is 26-30°C, but hatcheries would often elevate it to 33-35 °C to induce molting and shorten the production period. However, although risks of larval mortality are lessened, survival rate is increased, and growth is hastened, the adverse consequences of this questionable practice eventually catch up with the prawn, when they fail to develop the resistance to natural conditions in the nursery and grow-out ponds.

Deterioration of grow-out ponds. Several years of continuous use has naturally affected the present condition of grow-out ponds. Many of these ponds have been in operation for 10-15 years. But this problem is not limited to old ponds. Even new ponds may have deteriorated fast from neglect of proper pond preparation (i.e., tilling, drying of bottom soil, etc.).

Increase of stocking densities to unreasonably high levels. The carrying capacity of the ponds is often abused or overloaded. Because the land area in Tawian which is available for culture is very limited, the trend in prawn culture systems has been toward intensification. Cost of land in aquacultural regions is so prohibitive that production per unit area had to be maximized so that cost per unit pond could be minimized. To maxi-

mize production per unit area, prawn are stocked at high densities, making the culture environment conducive to the outbreak of disease.

Poor choice of artificial feed. Feed accounts for 50-60% of total prawn production costs. In their effort to cut down on costs, prawn farmers tend to choose the lower-priced prepared feed. Some feed manufacturers are, in turn, forced to push down their own production costs in order to offer more competitive prices, but are unable to do so without affecting product quality.

Indiscriminate use of medicine and antibiotics. Antibiotics and chemicals have been applied in excessive quantities. While this may improve the prawn's resistance to disease, such immunity is temporary. Once exposed to harsh or unfavorable natural conditions in the grow-out, the prawn becomes susceptible again to infection.

Inadvertent and sometimes unavoidable use of polluted water. The absence of an efficient, well-engineered sewerage and industrial waste disposal system in some areas of Taiwan has made water pollution a chronic problem. Culture water can easily become contaminated with effluent, including waste material discharged by the aquaculture farms themselves. Hatcheries are especially vulnerable, since the larvae are most sensitive to water quality.

Indirectly related to this is the unwieldy problem of water supply. Prawn farmers have been competing with households and agricultural users for the supply of freshwater, which they use to dilute seawater and obtain brackishwater. The uncontrolled pumping of freshwater from the underground water table has, in fact, resulted in serious land depression in the vicinity of aquaculture farms.

Lack of technical training of farmers. This is only partly a contributing factor, but one that nevertheless demands urgent attention and action. The impressive performance of the flourishing *P. monodon* culture industry and the rising prosperity of those who had entered it beckoned a big number of enthusiastic entrepreneurs. In their eagerness to put up their own farms and rake in a profit, though, many of them neglected to acquire basic knowledge and proper training on the technical aspects of *P. monodon* culture first, before embarking on a farming enterprise.

Absence of reliable system of sanitation. Failure to install effective sanitation systems has left hatchery facilities and grow-out ponds highly vulnerable to contamination by harmful microorganisms and has facilitated the spread of disease. Some farmers were plainly unaware, and others outright neglectful of the possible far-reaching consequences of poor sanitary practice.

Pathogenic Factors

Under the traditional polyculture and extensive culture systems, no major problems were encountered, except for the occurrence of natural disasters, and the presence of predators and competitors. As the culture systems shifted to semi-intensive and intensive styles, stocking densities were raised and formulated feeds were used. Water quality and the general culture environment became harder to manage, and culture species became more susceptible to various diseases.

Eventually, various types of infections, such as protozoan epicommensals, entozoic algae, black gill disease, gill decay, telson damage, body cramp, and red discoloration

were reported to have afflicted the prawn.

As long as culture conditions were optimal, *P. monodon* appeared to be able to tolerate light to moderate infections. However, it is obvious from the above (non-pathogenic factors) that farms have failed to maintain an ideal culture environment. In many cases, outbreaks have most likely been predisposed by stressors, such as poor water quality, deteriorating environmental conditions, poor nutrition, etc. Thus, it is not surprising that several pathogenic factors have been identified as part of the cause of the 1988 mass mortality.

The working group listed five factors:

- Bacterial infection of the hepatopancreas
- Bacterial and protozoan epicommensal infestations
- Concurrent bacterial infection of the hepatopancreas, and bacterial and protozoan epicommensal infestations
- Monodon baculovirus (MBV) infection
- A combination of MBV and bacterial infections.

RECOMMENDATIONS

In a truly constructive way of dealing with the crisis, the working group has produced a "Prawn Disease Prevention Manual." The manual has been disseminated to farmers. Another concrete output of the group is a series of intensive lectures on how to deal and cope with the problems of *P. monodon* culture.

The working group recommended a comprehensive scheme to prevent the recurrence of the disastrous mass mortality that struck the *P. monodon* farms last year. The scheme is outlined and summarized below.

Improved culture techniques

Improving the structure of the prawn pond. A well-designed pond construction equipped with a functional inlet, outlet and recirculating system will help reduce capital investment, maintenance and labor costs. Moreover, it can significantly reduce the occurrence of disease by creating more ideal culture environment.

Employing a segmental pond style. In this style or system, the ponds are built adjacent to one another. As the prawns grow, they are transferred from pond to pond with the use of water currents. This system does not utilize the entire pond space all at the same time. One pond is used at a time and for a shorter period, and while it is in use, the others are preserved and kept dry, thus preventing the deterioration of the pond bottom.

Crop rotation. It is strongly suggested that the species for stocking be varied and rotated. This practice has long been applied in agriculture, and it can also be used in aquaculture.

Improving feeding methods. This cannot be accomplished unless the basic digestive physiology and feeding behavior of the prawn are better understood. Studies on this area must be pursued further, along with research on the nutritional requirements of the prawn for every stage of growth, so that more effective feeds may be formulated and efficient feeding methods may be devised.

Maintaining ideal stocking denstiy. Stocking density should not exceed 30 pieces/ m^2. If the density is higher than this, it may cause too much stress for the prawn and will weaken their resistance to disease. An ideal stocking density is essential at a time when it is quite difficult to keep the larvae virus-free. As long as the density is maintained at an optimal level, even if the prawn are viral-carriers, they will not easily succumb to infection.

Meticulous pond preparation. Farmers must make it a point to do all the necessary preparations prior to stocking the ponds. For instance, the bottom soil must be properly tilled and dried to prevent deterioration.

Disease research and diagnostic techniques

Establishing a simple, easily applicable technique for identifying and diagnosing MBV infection. Such a technique will make it possible for prawn farmers to detect the presence of infection at its earliest stage, while it can still be checked and its spread can be prevented. A very helpful concept to impart to the farmers is that MBV is preventable. It is not necessarily fatal and its occurrence is not inevitable. In many cases, MBV is initially just a latent infection and afflicts the prawn only after it has been weakened and made susceptible by various stress factors or an initial or primary infection. As long as the farmers are aware of this, they will exert extra effort to take preventive measures, and in case an outbreak does occur, they will not feel helpless and will still strive to save the crop by maintaining an ideal environment, and without resorting to the use of drugs.

Intensifying disease research. The more intensive the culture techniques become and as more and more farms adopt intensive culture systems, the harder it is to avoid and handle disease problems. It is therefore necessary to strengthen disease research. Studies in this area must be encouraged and given financial, academic and institutional support. In addition, manpower supply should be augmented and capabilities in disease research enhanced through the education and training of more pathologists.

Disease prevention system

Such a system should include the production of virus-free, healthy larvae; installation of sanitation systems; development of vaccines; and breeding of disease-resistant strains through genetic engineering.

Stock enhancement

Stock enhancement programs must be started and continued, especially through sea ranching of virus-free subadults. Producing enough spawners locally will eliminate the need to import and will prevent accidental introductions of exotic disease organisms.

Exclusive aquaculture zones that will facilitate public inlet and outlet systems should be established in each major aquaculture area to avoid pollution of the water by industrial waste as well as by effluent from the aquaculture zone itself. Such zoning will also alleviate the problem on the shortage of ground water supply.

Prawn farmer training and licensing system

Prawn farmers must be required to undergo training, especially in proper and

prudent drug administration. This will hopefully discourage them from unbridled use of such substances. Farmers must be required to obtain technical guidance and adequate instructions before purchasing and applying chemicals.

Training of farmers is likewise needed on proper sanitation. It may be common practice among farmers to carelessly discard carcasses of disease-afflicted prawn, leaving them exposed. Farmers must be taught proper ways of disposing them, for instance, by burning or burying.

To be able to effectively enforce this requirement, the government should devise and implement a licensing system, so that only those who have undergone sufficient training will be allowed and given the permit to operate a prawn farm or hatchery.

Government regulations

The government needs to legislate stricter regulations and to be firmer in the enforcement of the existing ones. For instance, areas restricted to aquaculture must not be encroached upon by industrial plants and factories. Regulations should also cover the sale and use of aquacultural drugs, medicine and other chemicals.

CONCLUSION

Two decades is a very short time for a new industry to grow into a major one. But that was all it took for the *P. monodon* culture industry of Taiwan. The dramatic increase in production within such a brief period is a feat achieved nowhere else in the world.

There is always a price to pay for development, especially one that proceeds too fast. For the *P. monodon* culture industry, the price took the form of diseases and a damaged ecosystem. Those problems may have crept in insidiously over the twenty years, but they were never grave enough to interrupt the industry's smooth ascent. At least, not until 1988. In that fateful year, unfortunately, and in another sense, perhaps fortunately, the industry reached a critical point in its growth.

The *P. monodon* farmers of Taiwan will have their hands full in the next couple of years, just getting production back up to 1987 levels. Many tasks are still left to be done, and mistakes and oversights corrected. The crisis was a painful lesson to learn, for the industry, but one that both the farmers and the scientific community supporting them have begun to face and accept as a challenge.

Two decades in the history of P. monodon *culture has come to an end,* and the time has come for the industry to "molt", so that it may proceed to another stage in its development, in much the same way that the prawn must molt to be able to grow.

Source: I-Chiu Liao, *"Penaeus monodon* Culture in Taiwan: Through Two Decades of Growth," **International Journal of Aquaculture and Fisheries Technology,** Vol. 1. No. 1, April 1989.

AQD SPONSORS "SAVE THE FISH" POSTER-SLOGAN CONTEST

The Aquaculture Department of the Southeast Asian Fisheries Development Center is sponsoring the "Save the Fish" Poster-Slogan Contest to make citizens aware of the importance of conserving fisheries and other aquatic resources. It aims to educate ele-

mentary-grade children and out-of-school youth on the results of improper utilization of these resources, and to inculcate the value of resource conservation through parent-child partnership in the preparation of entries.

It is open to elementary-grade children ages 10 and below and out-of-school youth of the same age bracket in RegionVI. Entries should be prepared by child-parent partnership and should bear their names, signatures, and address. Children and dependents of AQD employees are *not qualified.* Contestants are entitled to only one entry each. Entries must be prepared on short bond paper (8 1/2" x 11"). Marking pens, pencils, water color, crayons or any other drawing materials may be used. The slogan should be in English or Tagalog and should not exceed five words. Entries shall embody the theme "Save the Fish."

Three major prizes will be given. First prize gets P10,000 plus trophy: second, P7,000 plus trophy; third, P5,000 plus trophy. Transportation allowance for two will be provided for the awarding ceremonies. Ten consolation prizes of P1,000 each will also be given. Deadline is not later than September 15, 1989. Mail entries to: "Save the Fish," c/o SEAFDEC AQD, Tigbauan, Iloilo.

For more details please contact: *Information Division, SEAFDEC Aquaculture Department, Tigbauan, Iloilo; Tel: 76642, 70505.*

SHRIMP FARMER WORKSHOP TO BE CONDUCTED

The United States Department of Agriculture in collaboration with private/government agencies is conducting a **Shrimp Farmer Workshop** in three Asian countries as follows:

July 28–29: Farmer Workshop, Manila, Philippines; Language: English; Contact: Mr. Bert Villa, San Miguel Corporation, Feeds and Livestock Division, Manila B-Meg Feed Plant, 658 A. Bonifacio, Balintawak, Quezon City, Philippines, Telephone: 353071 to 78.

August 2–4: Farmer Workshop, Surabaya, Indonesia; Language: English with translation to Bahasa Indonesia; Contact: Mr. Sofyan Ilyas, Research Coordinating Center for Fisheries, Badan Penelitian dan Pengembangan Pertanian Jalan K.S. Tubun, P.O. Box 50 Slipi, Jakarta 11410 A, Indonesia, Telephone: 5485210, 5480322.

August 8–10: Farmer Workshop, Hatyai, Thailand; Language: English with translation to Thai; Contact: Ms. Bung Orn Saisithi, Deputy Director-General, Department of Fisheries, Rajadamnoen Avenue, Bangkok 10200, Thailand. Telephone: 2810686, 2815577.

The topics and speakers are:

Extensive Shrimp Farm Management by Yosuke Hirono, General Manager, Pentec, Quayaquil, Ecuador. *Farm information:* Species – *P. vannamei*, Stocking density – 8/m^2, Pond size – 10 ha, Production – 800 kg/ha/crop.

Semi-extensive Shrimp Farm Management by Fritz Jaenike, Laguna Madre Shrimp Farms, Los Fresnos, Texas, U.S.A. *Farm information:* Species – *P. vannamei,* Stocking density – 20/m^2, Pond size – 4 ha, Production – 2 mt ha/crop.

Semi-intensive Shrimp Farm Management by Takuji Fujimura, Tetap Bakti Sdn. Bhd., Sabah, Malaysia. *Farm information:* Species – *P. monodon,* Stocking density – 25/m^2, Pond size – 1 ha, Production – 6 mt ha/crop.

Intensive Shrimp Farm Management by Bille Hougart, Oceanic Institute, Waimanalo, Hawaii, U.S.A. *Farm information:* Species – *P. vannamei.* Stocking density – 100/m^2, Pond size – 0.2 ha, Production – 18 mt ha/crop.

Shrimp Pond Preparation by Peter Der-Ming Chiang, President, Hanaqua Group, Taipei, Taiwan, R.O.C.

AVAILABLE PUBLICATIONS AT SEAFDEC AQD
(in addition to the price list published in *Aqua Farm News,* March-April 1989)

Biology and Culture of Sea Bass (Lates Calcarifer). P. Kungvankij, B.J. Pudadera, Jr., L.B. Tiro, Jr., I.O. Potestas. Network of Aquaculture Centres in Asia (NACA) & Regional Lead Centre in the Philippines (RLCP). NACA Training Manual Series No. 3. 1986, reprinted with permission as AEM No. 11, 1989. 70 pp. Domestic P100,. foreign US$35.

A Prototype Warm Water Shrimp Hatchery. P. Kungvankij, B.J. Pudadera, Jr., E.T. Tech, L.B. Tiro, Jr., E. Borlongan, T.E. Chua. NACA Tech. Ser., Selected Publ. No. 4 1986, reprinted with permission as AEM No. 12, 1989. 32 pp. Domestic P80, foreign US$30.

An Improved Traditional Shrimp Culture Technique for Increasing Pond Yield. P. Kungvankij, B.J. Pudadera, Jr., L.B. Tiro, Jr., I.O. Potestas, T.E. Chua. NACA Tech. Ser., Selected Publ. No. 5 1986, reprinted with permission as AEM No. 13, 1989. 14 pp. Domestic P40, foreign US$15.

Shrimp Hatchery Design, Operation and Management. P. Kungvankij, L.B. Tiro, Jr., B.J. Pudadera, Jr., I.O. Potestas, K.G. Corre, E. Borlongan, G.A. Taleon, L.F. Gustilo, A.S. Unggui, T.E. Chua. NACA Training Manual Ser. No. 1, Selected Publ. No. 1 1986, reprinted with permission as AEM No. 14 1989. 88 pp. Domestic P100, foreign US$40.

Shrimp Culture: Pond Design, Operation and Management. P. Kungvankij, T.E. Chua, B.J. Pudadera, Jr., K.G. Corre, E. Borlongan, V. Alava, L.B. Tiro, Jr., I.O. Potestas, G.A. Taleon, J.N. Paw. NACA Training Manual Ser. No. 2, Selected Publ. No. 2 1986, reprinted with permission as AEM No. 15, 1989. 68 pp. Domestic P100, foreign US$35.

SAFIS Manual – Culture of Sea bass. Domestic P30, foreign US$28.

Four circulation centers may be contacted:

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ERRATUM

Some words were inadvertently omitted in F.J. Lacanilao's article, "Coastal Enhancement by Artificial Reefs," page 10 in the March-April 1989 issue of **Aqua-Farm News.** *The paragraph should read instead:*

"The extended time frame for building a coral community is worth the wait because coral reefs can support a standing crop of up to two tons of fish per hectare and a sustained fish yield of 300 kg per hectare per year. Thus, if only all our 3 million hectares of coral reefs were intact today, they would be capable of producing 900,000 tons of fish a year, or nearly half our present total fish production."

Our apologies. –Ed.

AQUA FARM NEWS is produced bimonthly by the Publications Section, 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.