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Anatomy of the prawn industry in crisis: Taiwan experience

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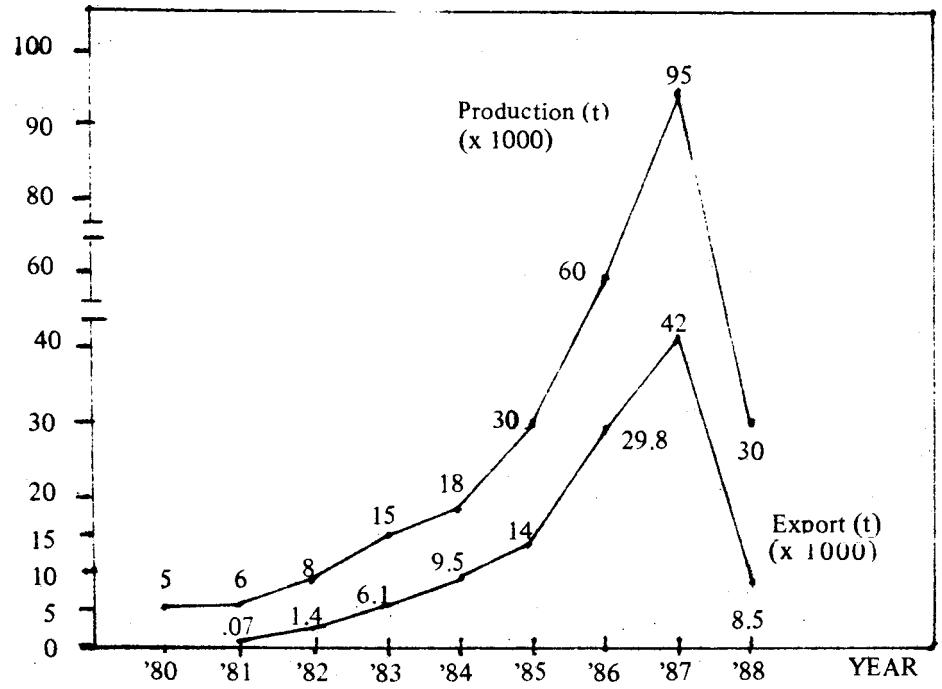
- The incidence of plankton blooms, their make-up, the circumstances in which they occur, the extent of the area they cover, and the way in which they can be handled.
- Advisable stocking densities.
- Acceptable alarm systems.
- The efficacy of vaccines.
- Working conditions in aquaculture.

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.