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SEAFDEC "Better life through aquaculture"

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# ASIAN SHRIMP SITUATION

A close look at cultured shrimp production figures points to Asia's predominance in the industry. Of the estimated world production of 560,000 tons in 1988, Asian countries produced 85.4% and the rest of the world, about 15% (Fig. 1). The major contributors to this "Blue Revolution" are China, followed by Indonesia, Thailand, Taiwan, Philippines, India, Vietnam, and Bangladesh.

In the case of capture fisheries, world shrimp landings totalled 2.04 million tons in 1987 as compared to 1.86 million tons in 1984. This is only a 9% growth rate, whereas in the aquaculture sector the growth rates were 25% and 27% in 1987 and 1988, respectively. Again, Asian shrimp producing countries were largely responsible for this accelerated growth. The market crash in early 1989, stemming from an oversupply of shrimp, and the subsequent reduction in production by shrimp producers in many Asian countries are, however, likely to contribute to a reduced growth rate in 1989 (Table 1) and probably in 1990, too.

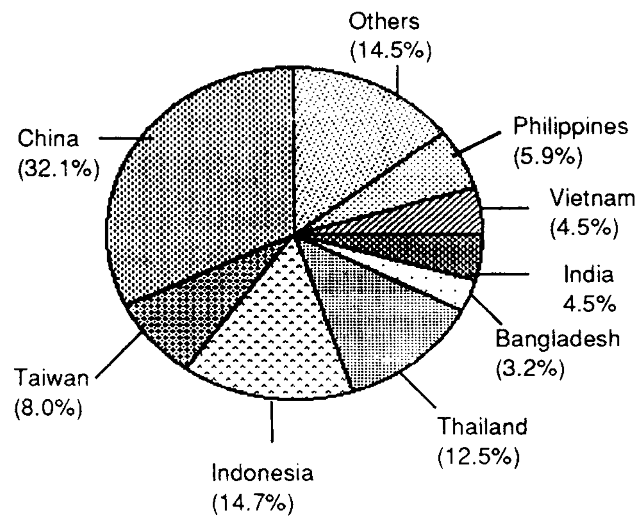



Fig. 1. Asian cultured shrimp production.

Table 1. Catches of shrimp by major producing countries, 1984-89 (In 1 000MT)

| Country | 1984 | 1985 | 1986 | 1987 | Share of world catch in 1987 (%) |
|---|---|---|---|---|---|
| Bangladesh | 61.0 | 70.0 | 73.0 | 74.0 | 3.6 |
| China | 207.1 | 229.2 | 200.1 | 192.5 | 9.5 |
| Taiwan PC | 100.7 | 107.7 | 137.0 | 126.5 | 6.2 |
| India | 203.1 | 232.5 | 214.7 | 216.7 | 10.6 |
| Indonesia | 132.9 | 144.1 | 157.3 | 140.9 | 8.2 |
| Malaysia | 70.1 | 69.0 | 72.9 | 72.9 | 3.6 |
| Philippines | 52.2 | 62.4 | 72.1 | 68.0 | 3.3 |
| Thailand | 136.2 | 126.3 | 139.5 | 150.1 | 7.4 |
| Vietnam | 52.0 | 54.1 | 55.4 | 56.0 | 2.7 |
| Japan | 62.9 | 55.0 | 47.9 | 47.8 | 2.3 |
| Brazil | 58.6 | 67.5 | 68.6 | 68.6 | 3.4 |
| Ecuador | 39.9 | 36.2 | 52.8 | 78.7 | 3.9 |
| Greenland | 41.5 | 52.4 | 64.1 | 64.1 | 3.1 |
| Mexico | 76.1 | 74.6 | 73.2 | 83.9 | 4.1 |
| Norway | 84.0 | 91.2 | 67.4 | 42.0 | 2.1 |
| USA | 145.0 | 152.7 | 183.3 | 165.0 | 8.1 |
| Others | 341.5 | 355.5 | 332.0 | 363.4 | 17.9 |
| Total | 1 864.0 | 1 980.4 | 2 001.3 | 2 011.1 | 100.0 |

*Still reeling from the impact of the Japanese market price crash, Asian producers look towards domestic market development, market diversification and product development as buffers against any future price drop.*

## Item One: Indonesia - Surviving in the International Market with Low Production Cost

Some 50,000 ha are in use for shrimp culture in Indonesia. The majority of the farms, i.e., 60%, use the extensive culture system whereas 20% and 10% are involved in semi-intensive and intensive farming, respectively.

Farmed shrimp production reflected a phenomenal growth rate of 27% over the last five years. In 1988, Indonesian farmers harvested 82,500 tons of black tiger (*Penaeus monodon*) (Table 2).

Like other shrimp producing countries in Asia, Indonesia also suffered a price drop in the international market in 1989. Nevertheless, farmers enjoy certain advantages over other shrimp producing countries in the region such as lower production cost which has helped the country survive in the international market.

Shrimp is the biggest contributor to the country's fishery exports. Exports of shrimp increased from 26,166 tons in 1983 to 56,552 tons in 1988, registering a 116% increase. Exports are very much dependent on one country, i.e., Japan. In 1988, 71% of exports were directed to the latter. Indonesia is, in fact, the number one shrimp supplying country to the Japanese market. During January-August 1989, exports totalled 32,039 tons against 24,314 tons for the same period in 1988.

The second largest market at the moment is Singapore which absorbed about 9% of the total export volume in 1988. Singapore buys much fresh/chilled shrimp from Indonesia for domestic consumption as well as for re-exports. Although fresh shrimp usually fetch higher prices, suppliers encountered a drastic fall in price in the market, too.

Meanwhile, more and more shrimp are being exported to Hong Kong and Malaysia and other European countries.

Some 80,000 ha along Indonesia's 80,000 km coastline have been identified for brackishwater shrimp culture. Of this, 50,000 ha are already in use and aquaculture is expected to grow in the near future. While still encouraging shrimp farming, the Government remains cautious about maintaining the current balance between intensive and extensive culture to keep farm level production cost as low as possible in view of the depressed international market price.

## Item Two: Thailand - Problem of Shrimp Feed Shortage

Thailand's cultured shrimp production doubled within a year to reach 70,000-75,000 tons in 1988, making the country the third largest cultured shrimp producer in Asia as well as in the world. The industry has expanded rapidly in recent years, especially in 1988 when shrimp prices increased markedly in response to higher demand in the international market and also due to continuous crop failure in Taiwan.

Since 1987, intensive and semi-intensive methods spread to almost all coastal provinces and farmers are culturing black tiger only.

Thailand's booming shrimp industry encountered initial problems of shrimp feed shortage and increased fish meal prices. In May 1989, Japan, the major market, cut back imports from Thailand because of its high inventory situation. As a result, the Commerce Ministry agreed to allow the

Table 2. Cultured shrimp production in Asia, 1975-88 (in 1 000 MT)

| Country | 1975 | 1980 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|---|
| China | 0 | 2.0 | 22.0 | 35.0 | 70.0 | 153.0 | 180.0 |
| Taiwan PC | 0.3 | 5.0 | 17.0 | 33.3 | 65.0 | 75.0 | 45.0 |
| Indonesia | 10.0 | 28.0 | 33.0 | 39.0 | 48.0 | 55.0 | 82.5 |
| Thailand | 3.3 | 10.0 | 14.5 | 15.0 | 16.0 | 30.0 | 70.0 |
| Bangladesh | 4.0 | 7.0 | 11.5 | 12.5 | 13.5 | 14.5 | 18.0 |
| India | 4.0 | 12.0 | 14.0 | 16.7 | 18.4 | 22.0 | 23.5 |
| Philippines | 1.0 | 1.5 | 26.3 | 26.5 | 27.9 | 35.4 | 33.6 |
| Vietnam | 1.0 | 4.0 | 7.0 | 7.0 | 7.0 | 15.0 | 25.0 |
| Sub-total | 13.3 | 69.5 | 145.3 | 185.0 | 265.8 | 399.9 | 477.6 |
| Other | 16.7 | 20.5 | 29.7 | 25.0 | 39.2 | 100.0 | 82.4 |
| World total | 30.0 | 90.0 | 175.0 | 210.0 | 305.0 | 500.0 | 560.0p |

p = Preliminary

import of 10,000 tons of high-quality fishmeal. Other decisions made were:

- 12 major shrimp feed producers agreed to reduce price by 12.75% in the case of direct sales to farmers through cooperatives and groups;
- the Department of Fisheries proposed limiting shrimp farming to 500,000 rai in order to maintain production between 100,000 and 300,000 tons; and
- the Department of Fisheries together with the Department of Trade and Commerce, Shrimp Farmers' Association and Shrimp Exporter's Association arranged shrimp exhibitions and cooking demonstrations from June to boost domestic demand for black tiger.

The 1989 black tiger price drop has indeed encouraged people to buy more shrimp. The major outlets are seafood restaurants. Almost all four- and five-star hotels operate Japanese, Thai, and Chinese restaurants where shrimp is an essential ingredient of various cuisines. Apart from tourists, there are some 50,000 Japanese expatriates who love shrimp.

Thailand exported 42,841 tons of frozen shrimp to the world market last year; 50% of this went to Japan, most of them being cultured shrimp. In 1987, this volume was only 11, 559 tons. As a shrimp supplier, Thailand ranked third in the Japanese market. Up to August 1989, exports totalled 25,459 tons against 12, 408 tons during the same period the previous year, placing the country second after Indonesia.

Thailand is also the number one canned shrimp supplier to the US market, maintaining an export volume of more than 15,000 tons for the last three years. In Europe, Italy is the major market; some 5,996 tons of frozen shrimp were exported in 1988. Exports to this market increased by almost 400% within a year. For cooked and peeled and canned products, UK remains the principal outlet. Fresh products are mostly sold to neighboring Malaysia and Singapore. For high-value products, Japan is the growing outlet for Thai packers who are, in fact, becoming more active in processing value-added products.

## Item Three: India - Seriously Looking into Market Diversification

Shrimp has been the "prima donna" of Indian fishery export since the early '70s and continues to remain so. Until 1987, India was the world's largest shrimp producing and exporting country. Landings from the capture fisheries remained between 175,000-200,000 tons during 1973-87 and it is generally felt that production from this sector will not increase further as the inshore waters are fully exploited. An estimated 58,430 ha are used for producing brackishwater shrimp in India with black tiger accounting for 50% of cultured shrimp.

Culture technology in India is very much extensive in nature because of the simple technology and low capital investments involved. Out of 58,370 ha, 50,000 are used for traditional paddy-cum-shrimp farming. The rest are semi-intensive.

Shrimp is hitherto the major fishery export of India. In 1988, Indian shrimp exports to the world market totalled 55,976 tons, reflecting 8% increase over 1987's volume. Valuewise, the increase is 15%.

Like other major suppliers, Indian shrimp exports are also very much dependent on the Japanese market. Unfortunately, the country is losing her market share to Indonesia, China and Thailand. Exports dropped from 32,352 tons in 1987 to 31,000 tons in 1988. During January-August 1989, exports trended upwards to 20,318 tons over last year's 18,881 tons.

In the US market, Indian shrimp consists mostly of peeled products totalling about 75%. During January-July 1989, exports totalled 8,818 tons (19.4 million lbs) as compared to the corresponding figure of 7,863 tons (17.3 million lbs) in 1988. India has been the number one peeled shrimp exporter to this market until last year but now has been overtaken (marginally) by China. Notwithstanding this, the US offers better opportunities than Japan in 1989.

Due to disappointments in the Japanese market, packers are now seriously looking into market diversification, with the target area being Europe. The United Kingdom, which is the third largest market for Indian shrimp, imported more shrimp in 1988. Exports to the market were 6,868 tons in 1988, almost double the 3,930 tons in 1987.

Packers, meanwhile, are now rushing to set up plants producing value-added products. The current agressive marketing efforts in Europe will certainly push more products to this market area.

## Item Four: Philippines - From Milkfish and Sugarcane to Shrimps

As of 1987, 210,000 ha have been utilized for brackishwater culture. An estimated 205,000 ha of this is under extensive shrimp and milkfish culture. Some 90% of cultured shrimp in the Philippines comprise black tiger.

Catches from the sea remained at a level of 63,000 tons on average during 1984-87 whereas aquaculture production increased from 9,287 tons in 1983 to 33,675 tons in 1988.

The rising consumption and price of shrimp has encouraged many sugarcane farmers to utilize their farm land for shrimp farming. Many fishpond operators in Luzon and Visayas have also switched from milkfish to shrimp. The Island of Negros is the most notable example - here sugarcane planters have switched to shrimp farming, setting up expensive aquaculture facilities. Most of the intensive farms are located in this area. The Philippines has been blessed with an educated work force and aquaculture expertise which has contributed towards the expanding of the shrimp culture industry. Furthermore, there is sufficient broodstock to help set up more hatcheries for fry production.

Intensive farming has developed rapidly in the Philippines. Latest survey results show that 40% of cultured shrimp in the country comes from intensive farms. Yield from these farms ranges from 2-10 tons/ha/year. Ex-farm price for black tiger has increased considerably during the last five years. Intensive farming has also given rise to some serious technical problems due to high stocking densities. To overcome this, farmers have reduced densities resulting in lower yields and high overall costs. Incidentally, cost of production in the Philippines is higher than in Indonesia due to high fuel, labor, and energy costs.

Although Japan remains the major market for Philippine shrimp (18,639 tons in 1988 against 11,794 tons in 1987), exporters are trying to sell more shrimp to other market areas. Exports to the USA have increased remarkably (7.6 million lbs in 1988 against 5.6 million lbs in 1987). During January-July 1989, Philippines' exports to the USA were 7.6 million lbs compared to 3.8 million lbs in the corresponding period in 1988. Other markets are Canada, France, Hong Kong, and Australia.

## Item Five: Malaysia - Shrimp Farming Expands at Slow Pace

Although the Malaysian shrimp culture history goes back to 1979, cultured shrimp contributes only 2 tons of the country's total shrimp landings. Shrimp landings in 1987 totalled 98,000 tons from the capture fisheries while harvests from the brackishwater ponds amounted to 1,500 tons only.

Malaysia has perfect climatic conditions for round-the-year shrimp culture. But due to lack of expertise and management problems several farms have failed until very recently. Foreign experts appeared to have overlooked local conditions when establishing projects.

Malaysia is a net importer of fishery products with a lot of shrimp imported from Thailand and Indonesia. These imports recently put farmers in a bad spot when shrimp prices dropped to their lowest in the international market during May-June 1989. Local products could not compete with the less expensive Thai and Indonesian shrimp, prompting the Government to initiate a campaign in early August to limit shrimp farming. Farmers stopped stocking for a while and as production volumes are not very big, the industry survived marginally, though having still to recover fully.

Shrimp farming is now expanding at a slow pace. The Government projection is 21,000 tons from aquaculture by the year 2000. Malaysia is not a major shrimp exporter; exports in 1988 were only 7,360 tons and comprised frozen headless, cooked and peeled, and canned shrimp. For headless products, the major markets are Japan and USA. Some fresh and chilled products are also exported to Singapore. Cooked and peeled products are exported to Australia and Europe. In 1988, canned shrimp exports totalled 4,559 tons.

## Item Six: People's Republic of China - Major Peeled Shrimp Exporter to the USA in '89

The People's Republic of China produced 32% or 180,000 tons of the world's cultured shrimp in 1988. The predominant species cultured is white *Taisho* or *P. orientalis.* Small volumes of *P. monodon* and *P. penicillatus* are also cultured.

Chinese shrimp culture grew by almost 79% during the last six years placing the country at the top of shrimp-producing countries. Total acreage of Chinese shrimp farms expanded from 9,300 ha in 1980 to 131,300 ha in 1987. Shrimp culture in China is very seasonal and takes place only during summer (4-5 months) because of the long and cold winters except in the southern areas.

China has also succeeded in expanding its market worldwide, to keep pace with production. *Taisho* continues to be the preferred species among the Japanese and imports into Japan increased from 10,307 tons in 1984 to 37,987 tons in 1988. China was the top exporter to the Japanese market last year. However, 1989 January-August exports seem to be lagging behind Indonesia and Thailand.

Last year, China became the principal supplier to the USA exporting some 24.4 million lbs (47,300 tons), taking over from India as the major peeled shrimp exporter to the US market in 1989. Until July '89 exports of peeled products were 17.8 million lbs (against a total of 68.1 million lbs) while those from India totalled 15.2 million lbs. Exports to UK increased from 182 tons in 1985 to 2,265 tons in 1988. The price of Chinese shrimp in the US market is usually 10% lower than the Ecuadorian whites, thus explaining its saleability in this market area.

The latest development is the emergence of Chinese black tiger exports in the Japanese market in October 1989. Some 3,284 kg of shrimp packed on ice in 10 kg styrofoam packs arrived in the Tokyo market from Fujan Province. The shrimp were reportedly blue shrimp weighing 34 to 51 g/pc and were relatively cheaper.

Besides being a major shrimp supplying area, Asia is also gaining prominence as an importer of fish and shrimp. In addition to Japan, there are three major markets in Asia that should not be ignored. These are Singapore, Hong Kong, and Malaysia. A great deal of intra-regional trade is evident in this area. Singapore has become an import market for neighboring Indonesia, Malaysia, and Thailand, reflecting a steady increase in imports of fresh/frozen shrimp.

In 1988, Singapore imported 22,457 tons of shrimp from Burma, Thailand, Malaysia and China. A substantial volume of Indonesian shrimp is either processed or re-packed in Singapore for re-export to other destinations. Singaporean processors buy shrimp from the neighboring Johore state of Malaysia where some Singaporeans have also invested in shrimp farms. Shrimps are also imported by truck from Thailand via Malaysia for domestic consumption as well as for exports. Because of stringent quality assurance, Singapore has the advantage of processing value-added shrimp and shrimp in consumer packs.

Hong Kong is another important market. Imports increased from 23,372 tons in 1984 to 71,622 tons in 1988. Its major supplier is, of course, China (exports being re-exported) followed by Vietnam, Indonesia, and Macau. Hong Kong is a re-processing center, too. Domestic consumption of shrimp among the ethnic Chinese community is also substantial.

The over-supply situation followed by plummeting prices of shrimp and a disappointing Japanese market in 1989 have served as a good lesson for Asian shrimp producers. Producers are now for the first time taking a closer look at the world supply situation. Certain countries now also realize that the development of domestic markets is very important as are market diversification and product development.

Source: Fatima Ferdouse, "Asian shrimp situation," **INFOFISH International,** No. 1/90, January/February.

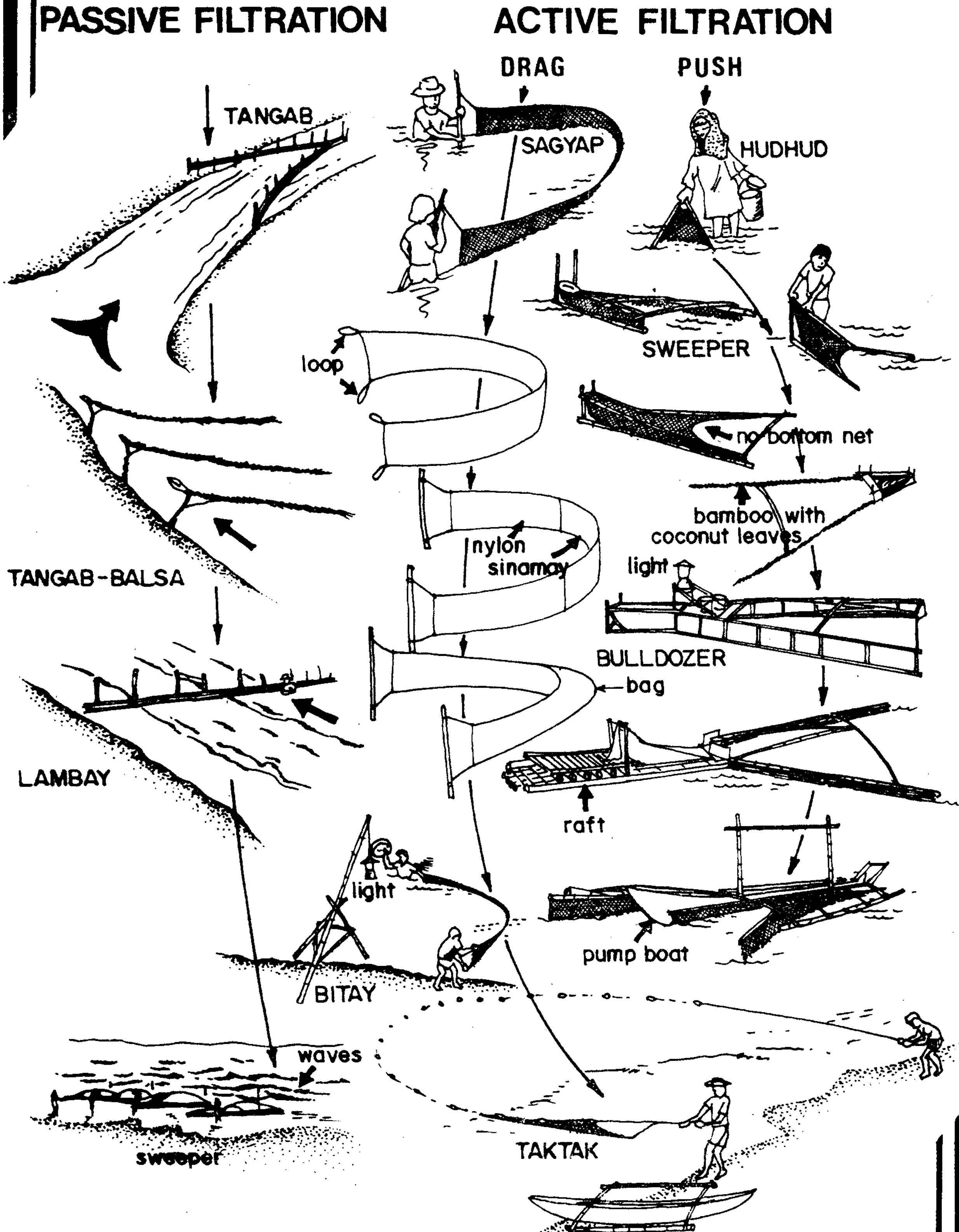
## FRY FISHING GEARS AND THE FISHING PRACTICE

The various fishing gears of Panay Island, Philippines and their modifications are summarized in the accompanying figure. The figure suggests the following tendencies in the development of the gear: increase in gear size and wing opening, extension of area of operation to offshore waters, and reduction of the bottom net (in the *sweeper*).

The development of the traditional *sagyap* into the *taktak* exemplifies increase in gear size and operation area. The development of the *sweeper* into the *bulldozer* demonstrates increase in gear size, extension of area of operation offshore, and loss of the bottom net. Coupling of the kerosene lamp with many of the gears has made night operation possible. All these trends of development reflect most obviously the economics of fry fishing and less clearly the behavior of the fry. First of all, the fishermen want to increase the catch to increase their income so that the gear structure and operation are made as extensive as possible, the use and cost of materials are seriously considered, and competition is avoided by varying the gears and the area of operation.

It is usually asked: How efficient are the various gears? Which one is the best?

It is very difficult to answer these questions and misleading to compare the catching efficiency of different fry gears. Each type has properties and advantages that cannot be equated with those of another. The different gear types operate under different, and rather specific, conditions as have been described. The physical effort involved in the operation differs from gear to gear, and for one gear, from place to place, from time to time. This is because the shore profiles of the fry grounds differ; so do the weather and sea conditions from day to day. Even if all the gear types were operated in the same fry ground at the same time a comparison would still be questionable because milkfish fry, it seems, are not homogenously distributed in shore waters. The catch depends heavily on where the gear is and where the fry are at a particular moment. A gear can catch from zero to several thousands. Catch data show that the *sweeper* had the smallest mean hourly catch among the three gears tested (*sagyap, sweeper,* and *bulldozer*). Nevertheless, it




The milkfish fry fishing gears: modifications and apparent trends of development.

would not be valid to say that the sweeper is the least efficient of the three. The *sweeper* in Hamtik (wings 4 m long, 3.5 m wide) requires only one person to operate, quite comfortably. The *sagyap* requires two fishermen, and the dragging could be strenuous (average duration of operation, 3.4 hours) considering the 6-7 m long net. The *bulldozer* requires two fishermen, is strenuous to push (average duration of operation, 3.3 hours), is operated at night, can cover a wider area, etc. The point is that evaluation of gear efficiency involves serious consideration of input and output. Comparison of the efficiency of different gears could be complicated.

The gears presently used are in themselves **practically fully developed** as far as actively fishing the fry is concerned. The main problem is in the proper use and operation. Use of a particular gear should be based on its suitability to the shore profile, currents, and such conditions as may affect its effective operation.

Moreover, the gears should be properly operated so that the fry are not only caught alive but healthy. Ten days operation of the *sweeper* in April-May 1980 between 6:00 A.M. and 6:00 P.M., showed that mortality rates during the fishing operation range from 2.6 to 41.2%, with mean of 14.3%. Examination of newly caught live fry showed a high percentage of injured ones irrespective of gear type, place, and sea conditions. Smith (1978) estimated that 5.3% of the available fry resources in the Philippines is lost during the gatherng process and 8.7% during storage. These figures seem rather small but all point to a need for improving the fishing operation. Capture is very stressful to the fry. With improper handling and severe injury at capture, the fry easily succumb to stress during storage. Ways and means to reduce fry mortality during capture should be studied. A few suggestions are in order in the meantime:

1 The *tangab* should be set where the current is strong, but not where it is too swift that it plasters the fry against the bag net, causing high mortality. The *tangab* should not completely block the river or creek mouth such that turbulence would occur and mortality would result. Milkfish fry should be allowed access to these coastal wetlands that serve as natural nurseries.

2. During the operation of any of the gears, drifting and floating debris should be removed as much and as often as possible so that they would not be scooped with the fry. Otherwise, their pressure against the fry can injure or kill the latter. Scooped debris presents sorting problems to the fishermen and more stress to the fry. This problem is especially serious and important in the case of the gear with lamp wherein nocturnal crustaceans overwhelm the fry.

Gear innovations that would make the fry fishing operation less strenuous and more profitable for the fishermen are also necessary. Two modifications of the *sweeper* were tested - one with wings of frame only and another with wings of coarse mesh (mesh 2 cm) dark-colored netting - and one modification of the *sagyap*, that is, with wings of coarse mesh dark-colored netting. The modifications were based on the premise that miklkfish fry could be caught by driving and therefore the fine-mesh netting at the wings of the gears could be done away with, in favor of coarse-mesh ones which would enable the fishermen to move the gear through the water more easily, and to use larger gears for bigger catch. In terms of catch, tests failed to prove this premise but the fishermen who operated the gears agreed that the modifications were easier to handle. In any case, all gear improvements and development should consider at least three factors: structure and operation of the presently used gears; conditions of the fry fishing grounds i.e. shore profile, currents, etc.; and behavior of milkfish fry.

Source: **A study on the milkfish fry fishing gears in Panay Island, Philippines** by S. Kumagai, T. Bagarinao, A. Unggui. Technical Report No. 6, September 1980, SEAFDEC Aquaculture Department, Tigbauan, Iloilo.

# TOXIFYING AND DETOXIFYING SHELLFISH

The rates at which shellfish accumulate and eliminate toxins are species-specific. Low water temperature seems to retard toxin loss but the precise relationship between temperature and the uptake and release of toxins is not fully understood. Further, the rate of detoxification is highly dependent on the site of toxin storage within the animal. Toxins in the gastrointestinal tract (e.g., the blue mussel) are eliminated more quickly than toxins bound in tissues (scallops; the clams *Spisula*, and *Saxidimus*).

The existing data on toxin retention for a number of bivalve species are summarized in the accompanying table. Mussel (*Mytilus* and *Modiolus*) accumulate paralytic shellfish poisoning (PSP) toxins faster than most other species of shellfish and also eliminate them more quickly. Oysters, on the other hand, accumulate the toxins more slowly than mussels, but they take considerably longer to detoxify. In contrast, species such as *Saxidimus giganteus* and *Spisula solidissima* may remain toxic for extended periods (in the case of *Saxidimus*, for more than 2 years). Differences among species regarding toxin accumulation and retention time should be given serious consideration when species are evaluated for culture in areas prone to toxic algal blooms.

Detoxifying shellfish contaminated with paralytic shellfish toxins has been attempted in an effort to reduce the "off market" period. The most obvious method is to transplant shellfish to waters free of the toxic organisms and allow them to self-depurate. While this is satisfactory for many species of shellfish, detoxification rates vary considerably between species and some remain toxic for extended periods of time. Detoxification using temperature or salinity stress has been tried with marginal success. Chlorination has also been used in France but this alters the flavor of the shellfish and decreases marketability.

Ozonation is a promising method although its capabilities are limited. Several investigations have used ozone to inactivate PSP toxins in shellfish exposed to blooms of *Protogonyaulax tamarensis, catenella* and *breve*, although others have obtained conflicting results.

Conventional wisdom now holds that ozonized seawater can be used to detoxify shellfish recently contaminated by the vegetative cell phase of toxic dinoflagellates, but not if they were intoxicated by cysts. In a study during a red-tide outbreak, ozone treatment of seawater prevented shellfish from accumulating paralytic shellfish poison. From these various results, it has been concluded that inactivation can be achieved in bivalves without measurably altering their physical state, and that it can be done rapidly enough to be economically feasible. Ozone is useless in detoxifying bivalves that have ingested cysts or have had the toxins bound in their tissue over long periods of time.

At present the economic feasibility of detoxifying shellfish on a large scale in artificial systems is questionable. In areas prone to regular outbreaks of toxic algal species, culturists and commercial fishermen alike must still depend on reliable monitoring systems to warn of toxic shellfish.

## Monitoring

The advantages of being able to predict the occurrence of potentially detrimental algal blooms are obvious. Early detection would allow officials to warn people, and a forewarning to culturist could save them from economic disaster. Unfortunately, what is lacking is an effective way of predicting the onset of algal blooms.

There is increasing evidence that most blooms originate in the ocean rather than in bays, and it is possible that key meteorological and oceanographic parameters could be used to evaluate the probability of a bloom. Oceanographers are already capable of identifying areas where there is a high probability that a bloom will occur, but accurate prediction is still not possible. Undoubtedly, as more studies explore the correlations between bloom events and environmental parameters, predictive capability will improve.

**Approximate toxin retention time for various species of bivalve molluscs**

| Species | Toxin Source | Retention Time |
|---|---|---|
| *Anadara maculosa* | *Pyrodinium bahamense* | 6 weeks |
| *Arctica islandica* | *Protogonyaulax tamarensis* | 2 months *in vivo* |
| *Choromytilus meridionalis* | *Gonyaulax catenella* | 3 months |
| *Clinocardium nuttali* | *Gonyaulax acatenella* | 9 weeks |
| *Crassostrea cuculatta* | not specified; probably *Pyrodinium bahamense* | 2 months |
| *Crassostrea echinata* | *Pyrodinium bahamense* | 3 weeks in closed system; longer *in vivo* |
| *Crassostrea gigas* | *Gonyaulax acantenella* | 1-9 weeks |
| *Crassostrea virginica* | *Gymnodinium breve* | 2-6 weeks |
| *Meretrix casta* | not specified; probably *Pyrodinium bahamense* | 1 month |
| *Modiolus auriculatus* | *Pyrodinium bahamense* | 6 weeks |
| *Modiolus modiolus* | *Gonyaulax tamarensis* | up to 60 days |
| *Mya arenaria* | *Gonyaulax acatenella* | 5 weeks |
| | *Gonyaulax temarensis* | 4-6 weeks |
| *Mytilus californianus* | *Gonyaulax catenella* | < one month |
| *Mytilus edulis* | *Protogonyaulax tamarensis* | 10-50 days |
| | *Gonyaulax acatenella* | 4-11 weeks |
| *Patinopecten yessoensis* | *Protogonyaulax tamarensis* | 6 weeks to 5 months |
| *Placopecten magellanicus* | *Protogonyaulax tamarensis* | 6 months in closed system; can be year-round *in vivo* |
| *Protothaca staminea* | *Protogonyaulax acatenella* | 5 weeks |
| *Saxidomus giganteus* | *Protogonyaulax acatenella* | >2 years |
| *Saxidimus solidissima* | *Gonyaulax catenella* | <one month |
| *Spondylus sp* | *Pyrodinium bahamense* | highly toxic after months |
| *Tresus capax* | *Gonyaulax acatenella* | 11 weeks |
| *Venerupis japonica* | *Gonyaulax acatenella* | 5 weeks |

Since most blooms originate offshore, satellite imagery, satellite-tracked monitoring buoys, aircraft and balloons could be part of an early warning system for detecting blooms. These vehicles would be equipped with sensors to monitor specific environmental parameters known to be asssociated with algal blooms. Instrumentation for satellites and aircraft has been developed which utilizes the light absorbed or emitted as fluorescence from algae. Unfortunately, there is no definitive way to distinguish between toxic and nontoxic blooms.

In the absence of predictive capabilities, monitoring remains the most powerful tool available to management. Monitoring of phytoplankton is simple and relatively inexpensive, and it can forewarn of potentially harmful conditions and detect new species that may pose a hazard. This type of monitoring is an integral part of mariculture in Japan.

Many countries have established comprehensive monitoring programs, but these are usually in response to a massive outbreak of toxic algae. It is an unfortunate human tendency to lavish the most attention on blooms that result in fatalities.

While regular water sampling and satellite monitoring will help locate toxic blooms in their early stages of development, the methods are by no means failsafe, making it difficult for farms and aquaculture facilities to plan their harvests. Even in the event of an early warning, it is impossible to prevent most species of bivalves from becoming toxic. An early warning can, however, prevent the sale and consumption of toxic shellfish and allow growers to harvest early or plan their harvests to minimize economic damage.

Source: Sandra E. Shumway, "Toxic Algae - a serious threat to shellfish aquaculture," **World Aquaculture,** Vol. 20(4), December 1989.

## BRIEF: THE WORLD AQUACULTURE SOCIETY

The World Aquaculture Society (WAS) is a non-profit international society which was established in 1969 and now has over 2,000 members in about 80 countries from all continents except Antartica.

The mandate of the WAS is to promote and evaluate the educational, scientific and technological development and advancement of aquaculture throughout the world; to gather/disseminate technical and other information on aquaculture worldwide; to hold meetings for the presentation, exchange and discussion of information, findings and experiences on all subjects and techniques related to aquaculture; to encourage the teaching of all phases of aquaculture and the training of aquaculture workers; and to encourage the support of aquaculture research, development and educational activities by government agencies, both national and international, and private industry.

This is accomplished through the organization of annual scientific meetings, and the distribution of both the peer-reviewed scientific and technical JOURNAL OF THE WORLD AQUACULTURE SOCIETY, and WORLD AQUACULTURE, a quarterly periodical of about 70 pages of reviews, reports, notes, etc. on aquaculture news, science and technology.

Membership in the WAS includes a subscription to *World Aquaculture* and the *Journal of the World Aquaculture Society* (both issued quarterly). Members furthermore receive discounts on registration at annual meetings and workshops, and on the book series *World Aquaculture Books.*

Membership categories and dues:

- **sustaining**: US$150 (membership for individuals or companies who wish to support WAS)
- **corporate**: US$150 (membership in name of company or institution)
- **individual**: US$30 (membership in the name of an individual)
- **individual**: US$27 (for members of WAS affiliate societies)
- **student**: US$20 (for student members provided they can attach copy of student identification or statement from professor)

Mail your payment by UNESCO-coupons, bank cheque (drawn on US bank), money order (in US$), credit card (Visa or Master Card) or cash (by registered mail) to: World Aquaculture Society, 16 East Fraternity Lane, Louisiana State University, Baton Rouge, Louisiana 70803, USA.

In some third world countries xerox copies of the WA-magazine and the JWAS will become available for students, technicians and governmental institutions at a nominal cost (in local currency) from the national/regional WAS contact person. You can request the mailing address of your country's WAS contact person from: Patrick Sorgeloos, *Artemia* Reference Center, State University of Ghent, Rozier 44, B-9000 Ghent, Belgium; telex 12754, telefax 32-91237326.

## THE ASIAN FISHERIES SOCIETY: FOCAL POINT FOR FISHERIES SCIENTISTS

The Asian Fisheries Society was established in 1984 with 14 charter members who signed the Society's constitution. By the end of its second year, it had nearly 700 members from 42 countries, fulfilling the long desire of Asian fisheries scientists to have a professional fisheries Society of their own.

The primary objectives of the Society are to promote effective interaction and cooperation among scientists and technicians involved in fisheries research and development in Asia with a view to encouraging and facilitating research activity implementation, sharing of information and publication of research results; to create and propagate an awareness of the importance and ways of sound utilization, cultivation, conservation and development of aquatic resources in the region; and to promote the establishment of national fisheries societies and to seek affiliation and cooperation with societies, organizations and institutions having similar objectives.

These objectives are to be pursued by providing an effective mechanism, in the form of an Asian fisheries journal for the dissemination of research and other relevant information; holding, on a regular rotational basis, an Asian Fisheries Forum as a gathering of scientists and technicians who, in their professional capacities can freely discuss broad issues and specific topics related to fisheries, and publishing the proceedings; providing further opportunities as appropriate for fisheries scientists and technicians to foregather by the holding of meetings, symposia, workshops, conferences or other gatherings; and addressing important issues related to fisheries interests in the region.

Membership categories are the following:

1. **Charter membership** - those (14) who signed the Society's constituttion.

2. **Full membership** - persons who are or have been engaged in a branch of fisheries research and possess apppropriate academic qualifications or through knowledge and experience occupy positions that normally require academic qualifications.

3. **Student membership** - persons studying relevant subjects at a tertiary institution who have yet to complete their award requirements.

4. **Associate membership** - persons interested in the objectives and activities of the Society who do not qualify for full membership.

5. **Institutional membership** - companies or organizations which support the objectives and activities of the Society.

6. **Sustaining membership** - companies or organizations which support the objectives and activities of the Society.

7. **Patrons** - persons who support the objectives and activities of the Society

For a country's members to get themselves more organized and become a louder voice in national fisheries issues, the formation of Society branches is earnestly encouraged.

The Society conducted the *First Asian Fisheries Forum* in May 1986 in Manila and the *Second Forum* in April 1989 in Tokyo, Japan where the present set of officers were also elected: President - Dr. Chua Thia-Eng, Vice-President - Mr. Darryl Grey, Secretary - Mr. Jay Maclean, and Treasurer - Dr. Flor Lacanilao.

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