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# Aqua Farm News Volume 14(06)

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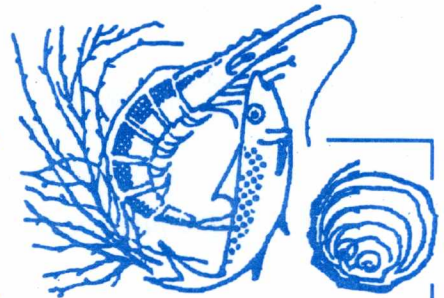
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# AQUA FARM NEWS

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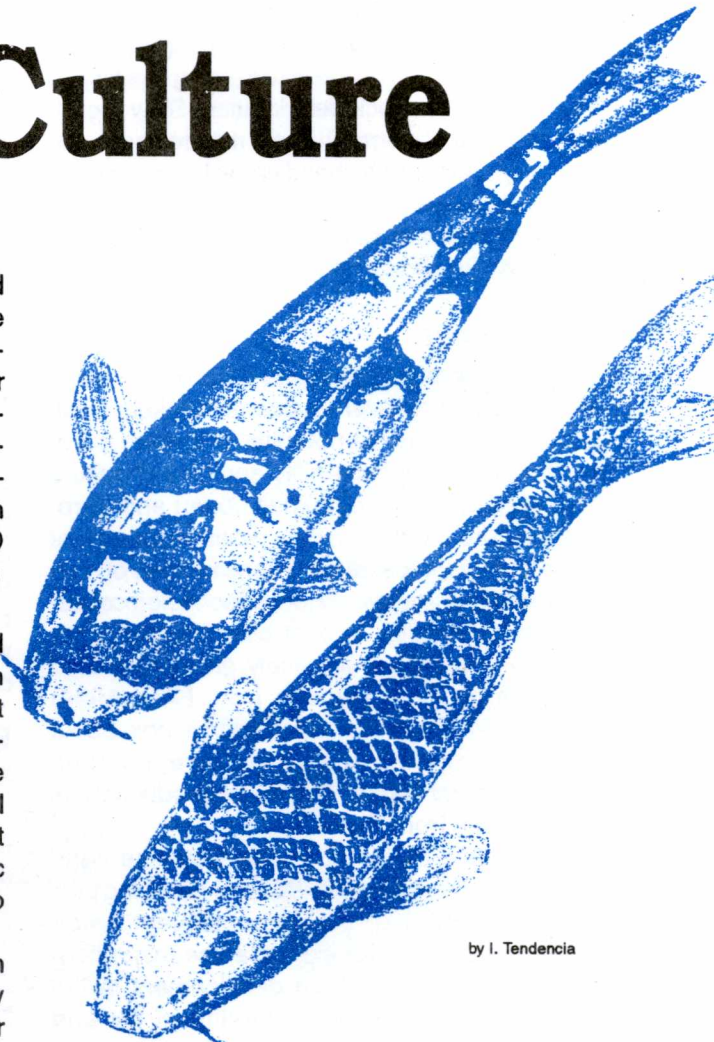
*the ideal option*

## Carp Culture

**I**ntensive aquaculture is considered one of the major contributors to pollution and with diseases plaguing the once sunshine prawn industry, fish farmers were "forced" to divert to other alternative species. For freshwater aquaculture, carp is considered as an ideal option because they are less vulnerable to environmental and culture stress. Moreover, the success in induced breeding and seed production of silver and bighead carps at SEAFDEC/AQD paved the way for the development of carp culture.

In 1989, E. Baluyut reported that bighead carp culture is four times more profitable than milkfish and six times than that of tilapia. Market acceptability is also growing. Other than for human consumption, other species like Japanese carp is a high-valued aquarium fish. Despite all these indications, however, there are reports that the global trend of carp production is either static or declining. These are said to be attributed to poor marketing strategy.

It is believed that with proper information and marketing campaigns, carp may eventually become an important food fish like any other high valued fishes.



by I. Tendencia

*Other than for human consumption, species like Japanese carp 'koi' is a high-valued aquarium fish.*

# What's up on Carp ?

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*Cage reared juveniles from cage-reared broodstock had the best growth rate*

## Local trend

Bighead carp is preferred among other species for culture because of its fast growth and high survival rate. Pen and cage culture of carps in Laguna de Bay is sustained by the availability of juveniles as a result of improved hatchery technology. The training on artificial propagation and seed production of bighead carp at the Binangonan Freshwater Station of SEAFDEC resulted in the growing number of hatcheries in the Philippines.

However, progress in large scale production of bighead carp in the lake is being challenged by problems on stock deterioration. Slow growth and physical abnormalities as manifested in the hatchery-produced bighead carps have been observed. Scientists agreed that broodstock management practices to prevent genetic deterioration of stocks should be improved.

## Global trend

Common, Chinese and Indian major carps are cultured wherever traditional markets exist. However, their culture potential elsewhere is limited by market acceptability and lack of culture experience in other countries. Asian and European culture production data greatly exceed that of other regions because intensification of culture practices and tremendous technological advances (especially in controlled breeding, genetics and nutrition) are likely given sustained research support. Reports from FAO (1994) showed that the global production is now about 6.6 million metric tons much greater than salmonids and tilapia. The major production as usual comes from China.

In spite of this optimistic view, the trend on carp culture is towards static or declining production in most of the more affluent Asian nations. In Vietnam for example, the major constraint of the carp culture development in the Mekong Delta is the availability of fry and

## Recent developments, SEAFDEC

SEAFDEC is conducting a study on the cage-reared broodstock being fed diets with or without supplemental vitamins A, E, and C. Assessment of reproductive performance was inconclusive as fertilization and hatching rates and larval production from three spawning trials were variable within and among treatments.

The commercial hatchery production of bighead carp in hatcheries around Laguna de Bay relies only on several broodstocks. Purchasing and exchanging breeders among hatcheries is a common industry practice that can lead to problems like inbreeding and negative selection. Thus, the breeding management practice of three commercial hatcheries were assessed based on the growth performance of juveniles. Juveniles were obtained from spawns of broodstocks grown in either ponds, cages, or reared in cages and conditioned in ponds prior to induced spawning. These juveniles were then reared in either cages or laboratory tanks. Growth after 90 days was best among cage-reared juveniles from cage-reared broodstock.

Mass production of the freshwater rotifer *Brachionus californicus* for nursery rearing of bighead carp larvae was studied. Mean population density and intrinsic growth rate was higher when the rotifer was cultured in *Scenedesmus* + chicken manure extract. The rotifer did not survive in filtered lakewater, green water, yeast, and chicken manure extract.

## BFAR (Bureau of Fisheries & Aquatic Resources)

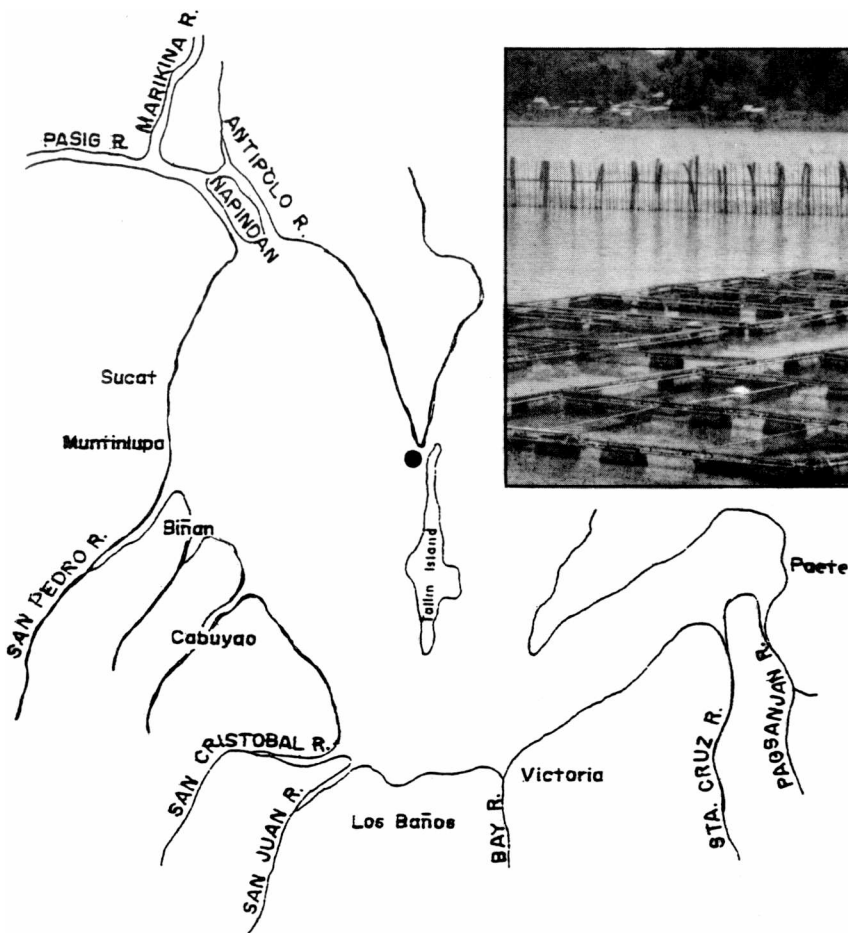
### Existing Research Programs for Carps:

The Medium Term Fisheries Management and Development Program (MTFMDP) studies on carp are geared towards:

- refinement of the polyculture technology utilizing various species of carps in combination with tilapia;
- development of carp open water fisheries; and

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Carp in floating cages (inset) at SEAFDEC/AQD's Binangonan Freshwater station in Laguna de Bay, the largest lake in the Philippines

*Global trend ..cont..*

fingerlings. This prompted the WES (West, East, South) Project at Cantho University to gear its program towards development of broodstock management, fish breeding, hatching techniques and larval rearing. The problem of seed supply may be addressed by the establishment of a jar-hatchery which was built parallel with the existing Chinese-type hatchery. The operation of these two hatchery systems will be compared. Since common carp in the Mekong Delta is the most degenerated species, a genetic improvement scheme is now underway by introducing Hungarian strains for crossbreeding experiments with local varieties.

The increase in the demand for carps and other farmed fish will compete with other agriculture products but fish is more acceptable and healthier food. The principal need of the carp industry world-wide at present is an appropriate marketing strategy for processed and package products with better consumer appeal.

Sources: (1) Gonzal, AC. 1995. *Prospects of Hatchery Development in the Philippines. International Training Course on Freshwater species.* (2) Pullin, RSV. 1988. *The worldwide status of carp culture. Aquaculture of cyprinids. L' Aquaculture des cyprinides, Billard et al., 1986.* (3) Nash, CE. and AJ Navotny. 1995. *In: Production of Aquatic animals: Fishes, Amsterdam Elsevier. p. 21-54. World Animal Science, C8.*(4) *Development of Seed Supply in the Mekong Delta of Vietnam, WES Newsletter, No. 3 April-June 1996.*

*Recent developments ..cont....*

- fish varietal regeneration towards the genetic improvement of carps.

**Approaches to genetic improvement:**

- BFAR serves as the national germplasm center for carps which works on its artificial propagation
- Stock improvement through selective breeding
- Conditioning of broodstock from the open waters in ponds and fishpens prior to spawning
- test culture of hybrids of major Chinese carp in ponds and cages to compare growth performance with parent species
- improvement of the gene pool for chinese major carp by maintaining pureline broodstock
- upgrading of common carp

# A perspective of the carp industry in the Philippines

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*Laguna de Bay is being tapped as freshwater source for domestic use: what happens to the carp industry?*

## From the fishfarmers

### **Dr. Alex King**

Dr. Alex King, a Doctor of Veterinary Medicine is into carp business for several years. He had his share of peak and lean harvest and this he said is attributed to weather condition.

"Carp business is profitable but I think the market strategy is poor, also post harvest and processing. It just doesn't appeal to the consumers." Other sellers desperately mislead consumers into buying their carp as red snapper. "If you are not keen you won't see the difference by their appearance. And maybe it's because carp if prepared and cooked well it tastes like red snapper".

"Things seem to be going better for carp until last year when the Napindan outlet to the sea was locked up preventing seawater to get into the lake".

"Gone are those planktonic food which abound when water in the lake becomes brackish and not as turbid as it is now".

### **Raul Aralar**

Being in the business for years, Raul seem to practically know all about carp culture. He's into both hatchery and grow-out. Obviously a profitable business, he is now improving and expanding his hatchery facilities located right at the back of his residence along Laguna lake.

Raul acknowledges SEAFDEC for the technology and assistance although he says there's still job to be done. Larval rearing techniques need to be improved. We still encounter problems during that stage.

"No, I'm not using the recent methods recommended by SEAFDEC to induce spawning because of the mixing protocol. I still use the traditional HCG + LHRHa. It's easier for me".

Raul expects a good market during the Holy week when everybody abstains from eat-

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## From the researchers

### **SEAFDEC (Andy Santiago and Lito Gonzal)**

It's not the end of the carp industry says Andy and Lito referring to the existing conflict of use of Laguna lake. This development however is putting the researchers of Binangonan Freshwater Station in a sad predicament.

Laguna lake is being tapped as a potential source of freshwater for domestic use. This would mean the closure of the Hydraulic Control structure in Napindan river. Plankton and other natural foods abound when the water is a bit brackish enhancing growth of fishes in the lake. No seawater means less or no plankton. "Bangus definitely will be out because of this", says Andy. Only tilapia or carp will grow but wouldn't be the way it should if the food is abundant.

While they sympathize with fish growers, water is also needed for domestic use. "We can import fish but we can't import water, says Andy claiming that SEAFDEC has to take its proactive role. "We have a ready alternative for that intensify carp/tilapia culture and venture into other species like catfish, mudfish or snakehead".

Both Andy and Lito agree that carp can really be a very important commodity but the marketing strategy should be improved. ICLARM, Andy says, is now involved in carp.

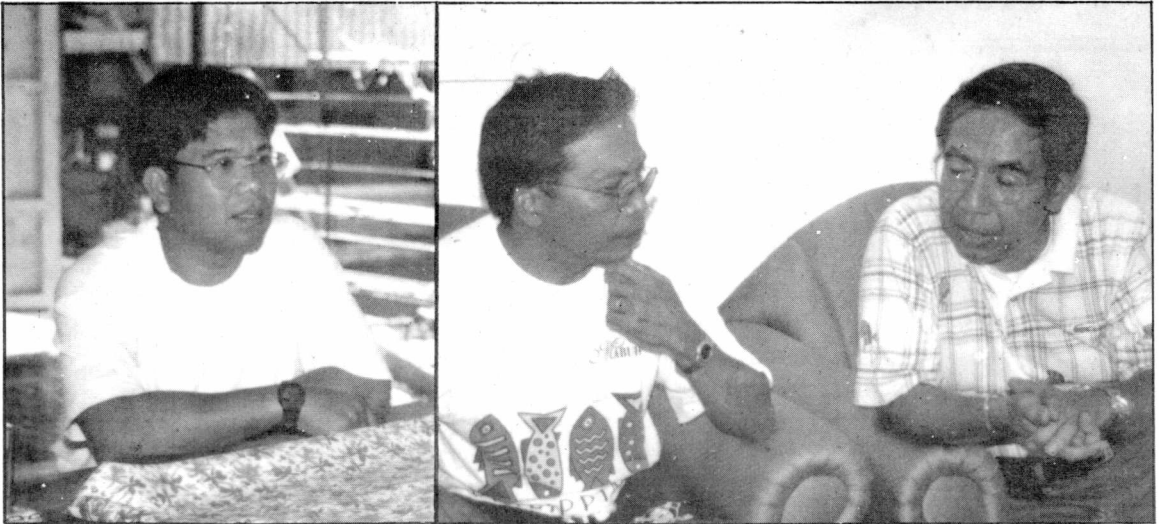
Lito thinks SEAFDEC should be a frontline ally of carp growers since we developed the technology for lake culture.

### **BFAR (Aida Palma)**

Aida, a strong ally of carp farmers emphasized the need to really put carp industry in line with other high valued fishes. A government extension worker, she loudly expressed her views of the apparent neglect for the carp industry, obviously referring to the lack of coordination between government agencies". Acceptance

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*Andy Santiago, station head of SEAFDEC Binangonan Freshwater station and researcher Lito Gonzal (right) explain the existing conflict of use of Laguna de Bay, Raul Aralar (left) is into carp grow out and hatchery business while Aida Palma of BFAR (below) looks forward to seeing carp industry in the forefront of freshwater aquaculture.*

ing meat. While he thinks there's no problem in marketing within the vicinity because of high demand, he laments poaching is still rampant. He said, he just lost stock of breeders last week.

"I think carp is more profitable business than tilapia, he said having had tried the two species. Carp grows faster for you can easily get a 1.5-2 kg after 4-6 months of culture. Before, two crops can be done in a year in either pens or cages but now, the food for carps are no longer abundant in the lake.

**Amer Mercado**

Amer thinks money is easier to get from carp than tilapia. Aside from being easy to culture, it grows faster. "Stocking 10,000 per ha in pens and with favorable weather, I could get 100-150 kgs. Even in my hatchery business it goes well if the weather is good". Like Raul, Amer's wife serves as his personal assistant, helping him out in records and financial management.

Amer attracts buyers by lowering the price of fingerlings. "In that way I can help struggling businessmen and encourage them to join the rolls of carp growers in Binangonan". The more the merrier. To those who want to engage in the business, here are the keywords: responsible, hardworking, goodwill and honesty.



*Aida Palma ... cont.*

of the fish in coastal areas maybe limited because there's a lot to choose from. The target should be focused on landlocked areas where carp could be highly acceptable. Aida is now actively gathering data on catches of carp where she thinks is under reported hence under valued. From there she looks forward to seeing carp industry in the forefront of freshwater aquaculture.

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*There is a wide acceptance of carp especially in land-locked areas where choices are limited. No doubt the business is profitable because carp growers who have been into the business could attest to this. There is however apparent neglect for or gap in the industry because despite these indications, carp culture is still unstable. Something should really be done to improve the marketing strategy.*

*The restriction of use of Laguna de Bay does not mean the end of the carp industry. Carp culture will even be intensified in lieu of milkfish. SEAFDEC and other research agencies, however, need to work together on the alternatives as regards impending scarcity of natural food.*

# What you should know about carp

*its origin, varieties, physical appearance, feeding habits*

Carp are often grouped on the basis of their natural geographical occurrence: the so-called Chinese carps, which include the grass carp, *Ctenopharyngodon idella*; the silver carp, *Hypophthalmichthys molitrix* and the bighead carp, *Aristichthys nobilis* and the so-called Indian major carps, which include *catla*, *Catla-catla*; *rohu*, *Labeo rohita*; *mrigal*, *Cirrhinus mrigala*; and the common carp, *Cyprinus carpio*.

## Grass Carp

Grass carp is a natural inhabitant of the flatland rivers of China and the middle and lower reaches of river Amur in the USSR. It has been introduced into many other countries mainly for

In natural waters, it attains a length of 15 to 30 cm weighing 225 g to 650 g at the end of first year; a length of 60 cm and a weight of 1.8 to 2.3 kg at the end of the second year. After four years, the weight may be 4.5 kg.

The daily growth of grass carp in different countries, observed to be 2.8 g in Siberia, 3.3 in Turkmenia and South China, 6.6 to 9.8 in Israel, 4.7 in India and 8.3 to 10 in Malacca. In Chinese ponds, grass carp attains a weight of 225 to 680 g in first year, 1,200 to 2,300 g in second, 2,700 g in third and 3,800 g in the fourth year.

Grass carp matures variably depending on climate and environmental factors, especially temperature.

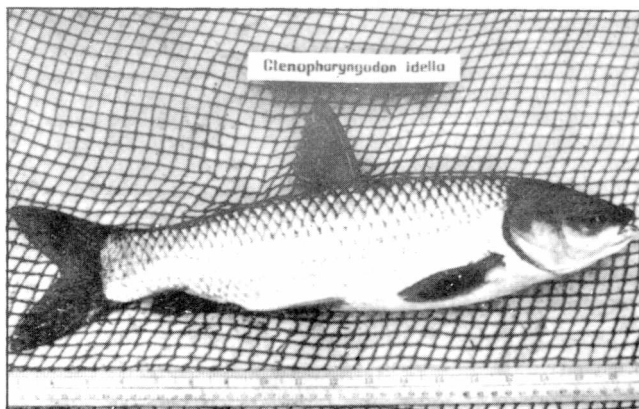
The fish breeds during monsoon months (July-August) in the flowing waters of its natural habitat, the rivers, but does not spawn naturally in the static waters of ponds and tanks.

## Silver Carp

Silver carp naturally occurs in the river systems, Yangtze, West River, Kwangsi and Kwangtung in South and Central China and in the Amur Basin in USSR and has been introduced into many countries for aquaculture.

It feeds on both phytoplanktons and zooplanktons, rotifers and copepod nauplii and expands as they grow.

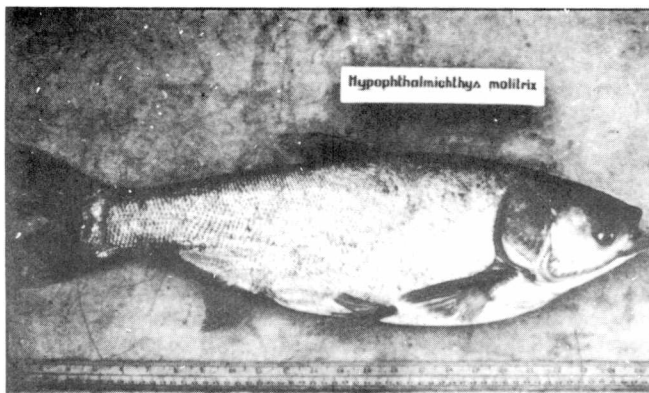
Under culture conditions, growth rate depends on stocking rate, natural food available and feeds given, competition with other species in polyculture, conversion rate of feed and envi-



biological aquatic weed control in natural waterways and in natural and man-made lakes.

Grass carp has a specialized pharyngeal teeth, the upper consisting of two small teeth on either side and the lower of strong comb or file-like teeth comprising four on the right and five on the left pharyngeal bone. In small fishes, the lower pharyngeal teeth have a serrated cutting surface, while in larger fish, the teeth are thicker and have double flattened serrated cutting and rasping surfaces. Large fishes can masticate even tough and fibrous grasses.

The fry and larger fish take cereal brans, oilcakes, silkworm pupae, kitchen refuse, night soil and dung which are often given as supplementary food.



ronmental conditions. Under favorable rearing conditions, the growth rate of fry of silver carp is extremely high in the first 10 days, the fish doubling its weight every second day. Silver carp attains highest growth rate in length in the second year of life and maximum growth rate in weight in the third year. Growth in both length and weight declines sharply after the third year.

Temperature has maximum effect on the maturity of silver carp just like grass carp but may not be applicable in locations other than China.

### Bighead Carp

Bighead carp is a natural inhabitant of the river systems Yangtze, West River, Kwangsi and Kwangtung of south and central China and has been introduced into many countries.

Primarily a zooplankton feeder, its food resembles that of the Indian major carp catla which also feeds on zooplankton. Its alimentary canal is much shorter, than that of silver carp. A considerable measure of competition for food may be expected between bighead carp and catla.

In aquaculture operations, growth rate would depend on rate of stocking, food available naturally from aquatic fertilization and supplied supplementarily, competition with other species. The rate of growth of fingerlings may be 6.3 g/day and of young adults, 14.7 g/day.

The maximum growth in length, occurs on the second year and maximum growth in weight, on the third year. The pattern of attainment of maturity follows the same principle as that of silver carp and grass carp.

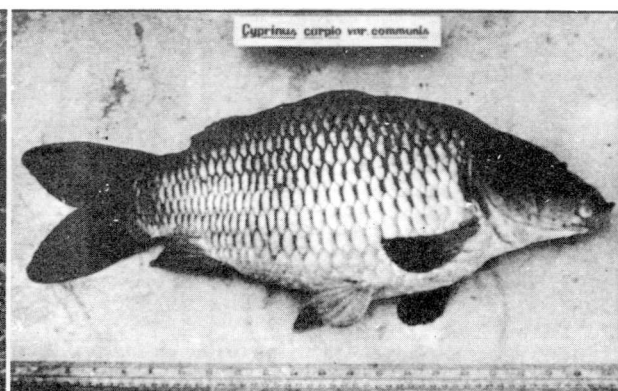
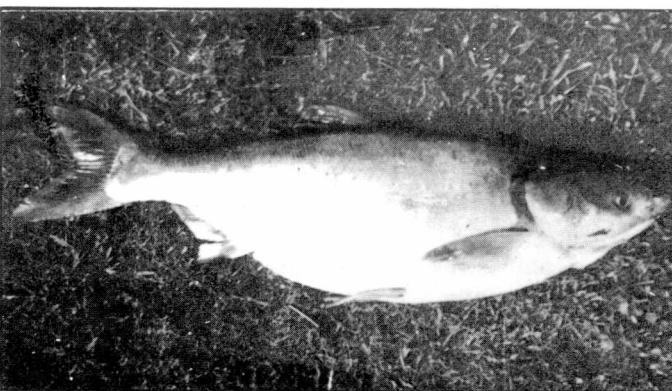
The fish breeds during monsoon months (July-August) in the flowing waters of its natural habitat, the rivers, but does not spawn naturally in the static waters of ponds and tanks.

### Common Carp

The common carp a native of temperate regions of Asia, especially China, has four sub-species: *Cyprinus carpio* of the European-Transcaucasian area; *C.c. aralensis* of the mid-Asian region; *C.c. haematopterus* of the Amur-Chinese or Far Eastern region and *C.c. viridiviolaceus* of north Vietnam. The natural distribution of common carp maybe restricted to a narrow belt in central Asia and has been introduced into scores of countries.

There are varieties and subvarieties or strains of common carp. The well-known variety of the Kwantung and Kwangsi regions of China is the 'big belly carp: and that of the Yangtze region, the "long bodied carp." The well-known Indonesian orange-colored carp (*Cyprinus carpio* var. *flavipinnis* C.V.) has been split into a number of subvarieties, such as the lemon-colored *Sinyonya* and the gold brown *Katiera domas*. There is also the green variety in Indonesia, the "Punten carp" with stable genetic traits. The "Majalayan" strain of West Java is also a greenish variety. The mirror carp (*Cyprinus carpio* var. *specularis*) of the Galician variety or of the Franconian variety were transplanted into Indonesia in the first half of the 20th century and are distinct from the Aischgrunder (Germany) or Royale (France) varieties. The Russian mirror carp (*Cyprinus carpio* var. *specularis*) is now split into two varieties, the scale carp (*C.c. var. communis*) and the leather carp (*C.c. var. nudus*). The other varieties of common carp are the Japanese races which go by the name of Asagi and Yamato; Ropsha and Kursk of USSR; Dinnyes of Hungary and Nasice of Yugoslavia.

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Common carp bigger than 10 cm thrives on decayed vegetation containing tubificids, molluscs, chironomids, ephemerids and trichopterans. Common carp digs and burrows into pond embankments and sides in search of food. The fish gulp in mud sifting digestible matter thus making pond water turbid.

Under favorable conditions, growth of common carp varies in different countries. Common carp breeds naturally in rivers as well as in ponds and tanks. The eggs are adhesive and the fish requires suitable floating matters for attachments.

### **Catla**

Catla is a natural inhabitant of the freshwater sections of the rivers of northern India, Pakistan, Bangladesh and Burma. Its favorite habitat are the deep rivers of north India and has been transplanted into Sri Lanka and China. Mixed seed of Indian major carps, which generally include catla, rohu and mrigal, has been exported to several countries.

While no distinct races or varieties of catla are known, catla, as a species is often confused with an allied form occurring in Thailand, *Catlocarpio siamensis* (Boulenger) due to their extraordinary superficial resemblance, especially their enormous heads.

A pair of five hybrids artificially produced in India, was induced to spawn by injecting pituitary hormone, producing a second generation of the hybrid. In 1960, several hundreds of golden colored catla were obtained from one artificially-bred specimen, and when interbred, all the progenies were found to be colored.

Catla is mainly a water column feeder and have a browsing habit as well. The presence of certain unattached submerged floating vegeta-

tion points out that the fish also explores the midlayers of water.

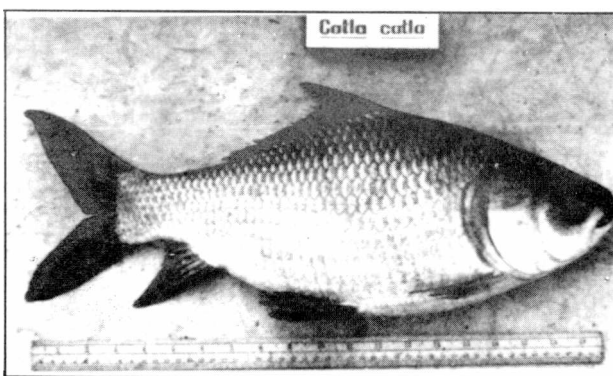
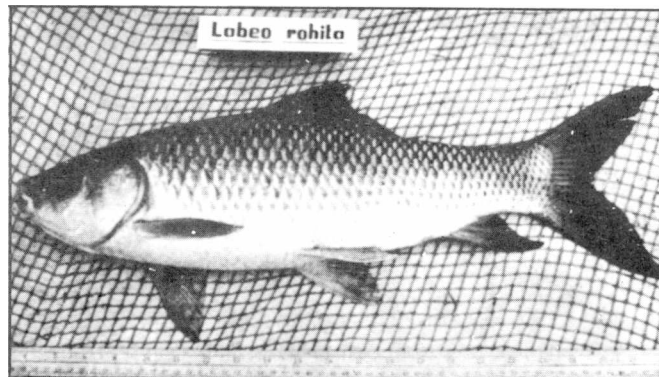
Catla is the fastest growing species of the major Indian carps and matures in its second year. In ponds catla matures after 22 months and in rivers, the second year.

The spawning season of catla coincides with the southwest monsoon in north-eastern India and Bangladesh, where it lasts from May to August and in north India and Pakistan, from June to September. In south Indian rivers, the spawning season is variable.

### **Rohu**

Rohu is found in the freshwater sections of the rivers of north India, Pakistan, Bangladesh, Burma and the Tera region of Nepal. It has been transplanted into some of the rivers of peninsular India and Powai Lake, Bombay, Sri Lanka and to Mauritius. Mixed along with the seed of catla and mrigal, rohu has been exported to USSR, Japan, Philippines, Malaysia, Nepal and some countries of Africa.

Rohu is both a bottom and column feeder and prefers to feed on plant matter including de-



caying vegetation; it is less adapted to take zooplankton than even mrigal. Utilization of plant matter is much better in mrigal and rohu than in catla. Rohu fingerlings subsist on unicellular and filamentous algae, rotting vegetation, rotifers and protozoans and crustaceans. The rotten vegetation component in the food increases in bigger fish.

Rohu is a quick growing fish although slower than catla and generally spawns during southwest monsoon in India.

## Mrigal

Mrigal is a natural inhabitant of the fresh-water sections of the rivers of northern India, Bangladesh, Burma and Pakistan. It has been transplanted into waters of peninsular India for aquaculture.

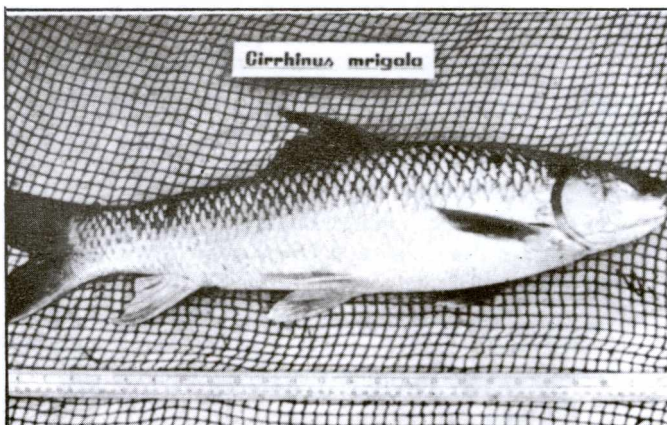
A large number of intergeneric hybrids has been produced at the Pond Culture Division of the Central Inland Fisheries Research Institute, India.

The first generation hybrids of male mrigal and female rohu were produced in 1958.

Mrigal is a detritus eater with a narrow range in food variety. It is a bottom feeder subsisting mainly on decayed vegetation. Some workers consider mrigal an omnivore also frequenting the water column for feeding.

In natural waters, the fish shows a very rapid growth rate in the first four years of its life, followed by a period of slow growth in the next three years. The growth rate thereafter becomes even slower.

A highly varied growth rate under culture condition depends on stocking rate, natural food



available and supplemental feeds given, competition with other species and environmental conditions.

*Sources: A Hatchery Manual for the Common, Chinese and India Major Carps. V.G. Jhingran, R.S.V. Pullin. 1985.*

*Culture of Carps in Pens and Cages. International Training Course on Freshwater Course. Training and Information Division, SEAFDEC, Tigbauan, Iloilo.*

## Do you know?

- 1. It is traditional for many continental wives particularly Eastern Europe to serve carp at Christmas just as in the U.K., U.S. & Canada were turkey.*
- 2. Carp culture dates back to more than 3000 years in China. The practice was first described by Fan Li in 473 BC. However, during the Tang Dynasty (618-907) common carp raising was banned because the name of the emperor was "Li" which sounded the same as the Chinese name for it. It could not be kept or killed and therefore alternative species were sought to replace it resulting to successful breeding and production of the major carps - each with own feeding habits*
- 3. The production of colored carp - the Japanese "nishikigoi" - presently exceeds in monetary value the production of carp as human food. The nishikogoi as "swimming flowers" delight modern people as much as the taste of carp delights the Romans.*

# Bighead carp - its maturation and ovulation

*Combined LHRHa+domperidone can effectively replace the existing injection protocol*

Bighead carp, *Aristichthys nobilis*, is the most popular cultured carp in the Philippines. Attaining the size of 1 kg in 4-6 months without supplemental feeding in floating cages and pens, the fish matures sexually in 2 years. The highly turbid condition in the lake, carried by the continuous mixing and resuspension of sediments in the water column do not adversely affect the growth and sexual maturation of bighead carp. Although they mature and remature the whole year round under cage conditions, bighead carp do not spawn spontaneously. The fish is induced to spawn by hormone injection.

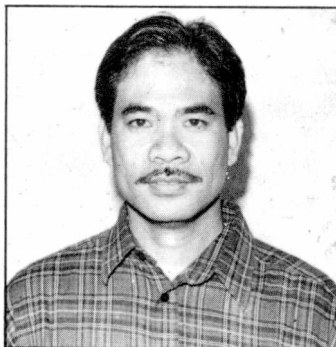
The use of synthetic luteinizing hormone-releasing hormone (LHRH-a) stimulates oocyte maturation and ovulation in several finfishes, however, this hypothalamic decapeptide alone did not induce ovulation in common carp. An injection of a dopamine antagonist (domperidone or pimozide) was required to induce oocyte maturation and ovulation in some cyprinids.

A study was conducted at SEAFDEC using twenty-one 3-4 year old female bighead carp selected from fish stocks reared in floating net cages in Laguna Lake.

The combination LHRHa and Domperidone using *Motilium* tablets dissolved in dimethyl sulfoxide) was compared to the existing injection protocol using HCG and LHRHa.

The findings revealed that a combination of LHRH-a and domperidone (*Motilium*) can effectively and sufficiently replace the existing injection protocol of HCG + LHRH-a to induce spawning of bighead carp. The lower combined cost of LHRH-a and domperidone will benefit

carp hatchery operators as well as fish culturists in the Philippines through a reduction in cost of bighead carp fry and fingerlings.



Armando C. Fermin,  
Scientist, SEAFDEC/AQD

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*This paper won the author, the best paper award in the Fisheries and Aquatic Resources Category during the 1992 DA-BFAR National Research Symposium.*

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Hydration response of oocytes in fish injected with HCG + LHRH-a and LHRH-a+DOM caused significant increases in oocyte diameter of 7.5% and 7.0%, respectively. Carp injected with LHRH-a or DOM had an average oocyte diameter increases similar to the saline-injected fish.

The study indicated that injection with dopamine receptor antagonists such as pimozide and domperidone caused significant increases in serum GtH. Final oocyte maturation and ovulation in some cyprinids are induced by a preovulatory GtH surge similar to spontaneously ovulating goldfish.

Multiple injections of *Motilium* domperidone in (liquid form) which was needed to equal a 15 mg/kg-dose using the tablet form stressed the fish. Cost comparison indicated that the injection protocol using LHRH-a-DOM is more economical than combined

HCG+LHRH-a. The 1992 cost estimate of hormone dosages per kg of bighead carp shows a combined cost of P68.25 (P22.80=US\$1.00) for LHRH-a +DOM compared to P134.00 for HCG+LHRH-a. *Motilium* can be purchased locally at P3.00/tablet of 10 mg domperidone. The 1992 prices for HCG and LHRH-a distributed locally are approximately P650.00/10,000 IU and P850.00/mg, respectively. The use of low cost and locally available spawning agents such as domperidone (*Motilium*) can effectively reduce operational expenses in carp hatcheries.

*Source: Fermin, AC. LHRH-a and domperidone-induced oocyte maturation and ovulation in bighead carp, Aristichthys nobilis (Richardson). Aquaculture 93 (1991) 87-94.*

# Broodstock Management

*an integral part of hatchery techniques*

The primary concern of any fish hatchery is to produce a maximum number of high quality eggs and fry. The quantity and quality of seeds depend largely on the condition of the broodstock, method of propagation, availability of appropriate food and environmental conditions.

As an integral part of hatchery techniques, broodstock management will determine the quality of resulting fry and fingerlings.

## **Selecting broodstock:**

- free from any physical deformities
- well developed sex organs
- high fecundity of females
- male carp produces a running milt on slight pressure on the abdomen, rough pectoral fins, and callousness on the head and body.

## **Notes on broodstock management**

- Broodstock management in tropical climates is different because of the possibility of sexual rematuration during the annual reproductive cy-

cle. Male and female fish should be kept in separate cages or ponds. Maturing broodstocks must be separated from the spent spawners for easy management and selection. Low stocking rate and feeding will enhance gonadal development in females.

- When rearing broodstock in pond, broodstock feed should be varied according to season. Spent and maturing breeders should be given a mixture of 50% natural food organism rich in protein and 50% artificial feed with high content of carbohydrates. Later, when the dormant eggs have been developed and the fish are ready for spawning they should be given artificial diet with low protein content to prevent accumulation of fat in their gonad.

- Mature breeders are brought into the hatchery for spawning and immature breeders are put back into the pond and cages, while invalid or unhealthy fish are sold in the market. The breeders selected for artificial propagation should be

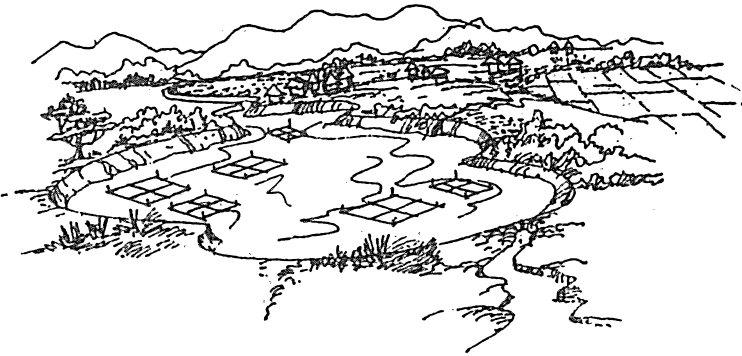
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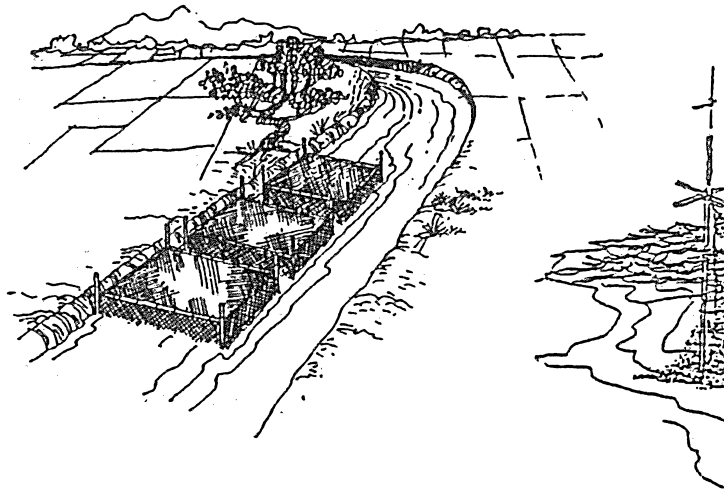
*Selection of sexually mature broodstock of cage-reared bighead carps.*

# Carp culture in different ways

Successful carp cage project in lakes from *Cages, controversies and conflict: Carp culture in Lake Toba, Indonesia* by R.B. Pollnac and S. Sihombing. 1996. *Aquaculture Development: Social dimension of an emerging industry*. Bailey et al. eds. pp 249-262



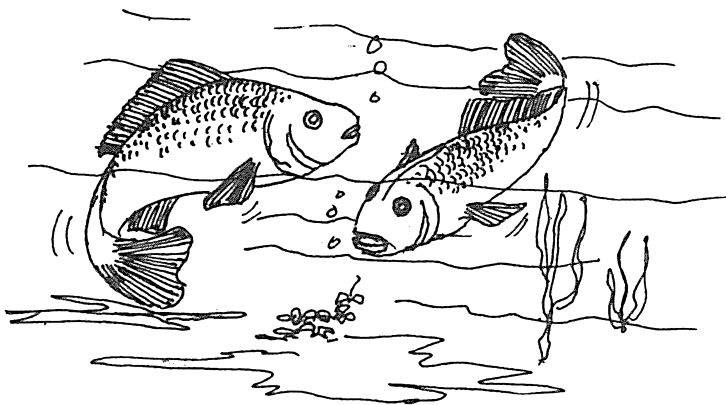
An average size three-cage farm could support an Indonesian family of five well above the national poverty level. from *Economics of floating net cage common carp culture in the Saguling Reservoir, West Java, Indonesia* by Rusydi and HC Lampe. In: *Reservoir fish and aquaculture dev. for settlement in Indonesia*, Costa Pierce, BA et al. 1990. No. 23 pp 218-239.



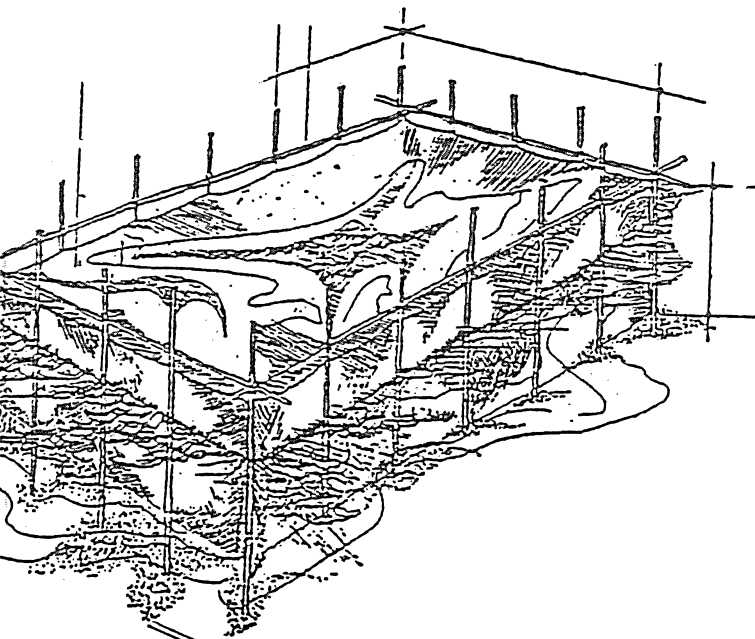
Polyculture of common, silver and bighead carps in ponds can better utilize natural food and low stocking density is of great ecological importance. In: *Possibilities and limits of carp pond culture in central Europe*. Stephens, W. *Discovery to Commercialization*. Carillo et al. eds. 1993. p. 19 p. 1996.



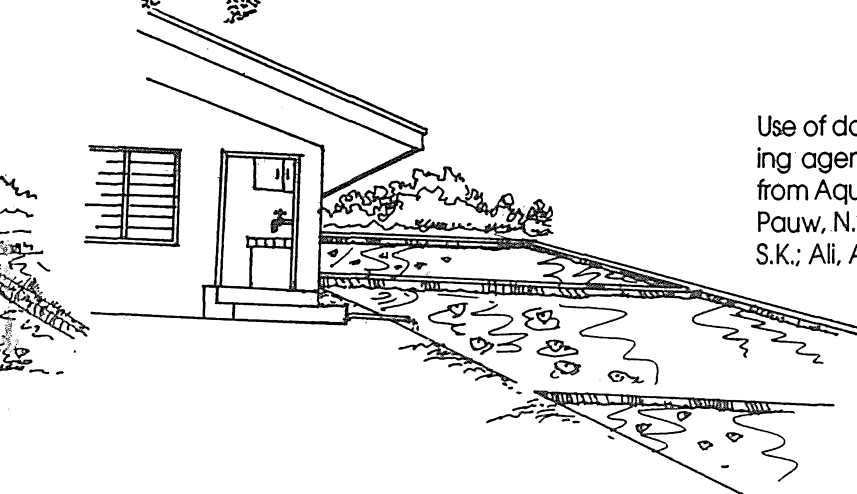




Carp in pond with minerals resulted in less feed cost, saved one month of culture period, increased production by 7 tons and better growth of individual fish. *Int. Role of minerals in carp culture* from Fish Chimes. 1993. vol. 13, no. 8 pp. 37-38 by M.B. Rao.



Carp in cages polycultured with milkfish and tilapia in Laguna lake (SEAFDEC/AQD's Binangonan Freshwater Station) Philippines) from Polyculture of bighead carp, common carp and Nile Tilapia in cages in Laguna Lake. *Fish. Res. J. Phil.* 11 (1-2) 13-20.



Use of domestic waste (kitchen) as a fertilizing agent in growth of Indian major carps from Aquaculture and the environment. De Pauw, N.; Joyce, J. 1991. No. 14 p. 85 by Das, S.K.; Ali, A., Borthakur, S.

# a carp hatchery

*Its essential components, site, proper hatchery operation procedures*

## The Site

The following can be an ideal site for a carp hatchery:

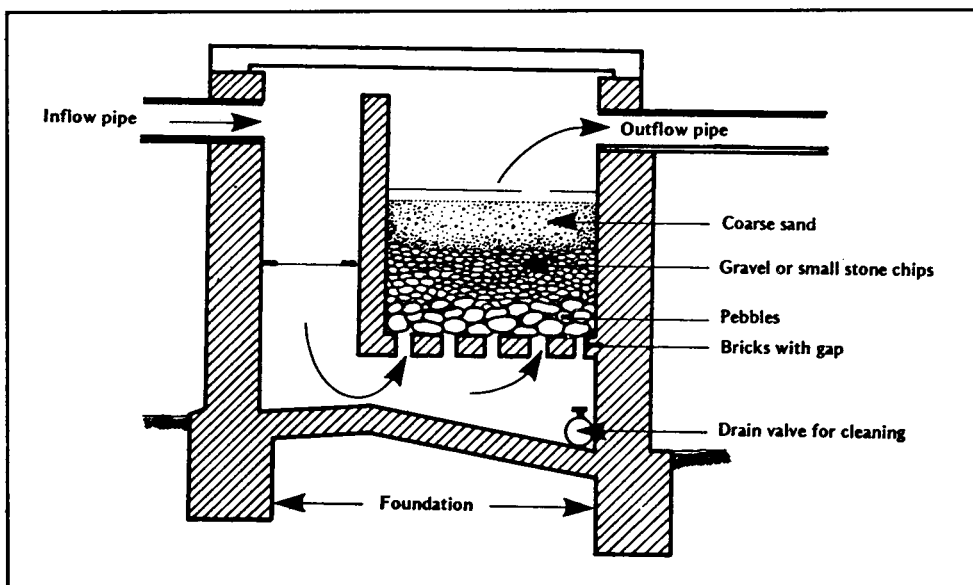
- ponds excavated at the site should provide a water retentive soil base, exposed by digging or transfer of top soil of the site to pond bottom and embankments;
- the pond bottom soil should possess basic mineral nutrients and respond readily to organic and inorganic fertilization;
- there should be an adequate source of water to supply the proposed hatchery;
- self-draining ponds can be constructed on sloping sites;
- the physical and chemical properties of the water are within the acceptable limits, such that water quality can be further manipulated by chemical treatment to suit aquacultural needs;
- the site is easily accessible by any means of transportation;
- there is a market in the vicinity;
- fertilizers and raw material for feeds required for aquaculture operations and building material

for constructing the hatchery are available near the site;

- there is no industrial, domestic or pesticide pollution at the site;
- there are reasonable educational and medical facilities available in the vicinity of the site;
- there may be scope for integration of aquaculture with agriculture, horticulture or floriculture at the site.

## Essential components of a hatchery

- broodstock ponds to hold adult fish for spawning or serving as donors of pituitary glands and to accommodate spent females and males;
- a hatchery proper comprising a recuperating complex of facilities for fish spawning, hatching and care of hatchlings up to postlarval stage;
- nursery ponds for rearing postlarvae to fry stage;
- rearing ponds for growing fry to fingerlings;
- ponds for mature and maturing adults.



*A reverse flow filter*

*These recirculating hatching tanks are suited for medium-to-large-scale bighead carp hatchery*



### **Proper hatchery procedures**

- Before releasing any broodstock, the ante-tank should be filled with pond water and an anti-septic substance.
- To prevent broodstock from jumping out, the ante-tank should be covered with netting having weights (like seine-net-sinkers).
- Only filtered, clear, cool, clean and oxygenated water at 27°C should be used in circular tanks.
- Its water level and outflow should be controllable by operating turn-down pipes.
- The rate of flow of water in the circular tank should be 30-45 liters per minute.
- There should be a net cover with sinker-like weights for the breeding tank which should be used to cover the tank after the broodstock have been injected and released in it.
- To safeguard against unexpectedly early breed-

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**Note:** *A study conducted at SEAFDEC showed that the water hardness concentration significantly affects hatching rate of silver carp eggs. A water hardness of 300-500 mg/l CaCO<sub>3</sub> is recommended for the successful hatching of silver carp. The paper entitled "The Effects of Water Hardness on the Hatching and Viability of Silver Carp (*Hypophthalmichthys molitrix*) Eggs" from this study, won A. Gonzal and his co-authors E.V. Aralar and J. F. Pavico the Naga Best Paper Award in 1989. Ed.*

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ing after injection (or occasionally even without injection) screens should be put in position.

- After spawning has taken place, a circular air diffuser should be installed at the base outside the screen and air from compressor or blower bubbled to keep the screen free from eggs.
- Spawners must be removed from the circular tank after eggs have been completely spawned. They must be given prophylactic treatment in ante-tanks before releasing in a broodstock pond or spent fish pond for possible subsequent maturity.
- After hatching has occurred, the rate of flow of water through the circular tanks should be increased to 45-50 liters per minute and a 5-8 mm meshed nylon net stretched across the tank in a slanting position to collect the discarded egg shells. The nylon net should be retrieved every few minutes to collect cast-off egg shells.
- If the clogging caused by egg shell bits is not remedied, the central screen fitted into the drain should be carefully replaced by a new one.
- The hatchlings may be left in the circular tank for four days if a second shift of egg nursing is not to be undertaken. If a second shift is to be undertaken within this period, then the hatchlings should be seined off and removed to the ante-tank.
- It is essential to periodically brush and hose-wash the screen and keep it completely clean after it has been used once in a breeding tank for few continuous days.

*Source: Jhingran, VG and RSV Pullin. 1985. A hatchery manual for the Common, Chinese and Indian major carps.*

# Carp culture in the Philippines

## *polyculture with tilapia and other milkfish*

Different species of carp were cultured along with milkfish and tilapia at SEAFDEC Binangonan Freshwater Station to verify feasibility of carp polyculture with other species. The following were the significant findings:

- All species in polyculture reached marketable size after 4-5 months of culture.
- Fastest growth was exhibited by bighead carp (7.1-10.0 g/day) followed by silver carp (5.3-5.7 g/day) milkfish (1.8-2.1 g/day) tilapia (1.1-1.7 g/day) and common carp (0.8-1.3 g/day).
- The growth rate of silver carp (as major species in polyculture) was three times higher than that of the milkfish at the same stocking density and ratio.
- The addition of bighead, tilapia and common carp did not hamper the growth of the primary species (silver or milkfish) but rather increased production by 9-11%.

Bighead carp showed the highest recovery (90-100%) followed by milkfish (86-93%), silver carp

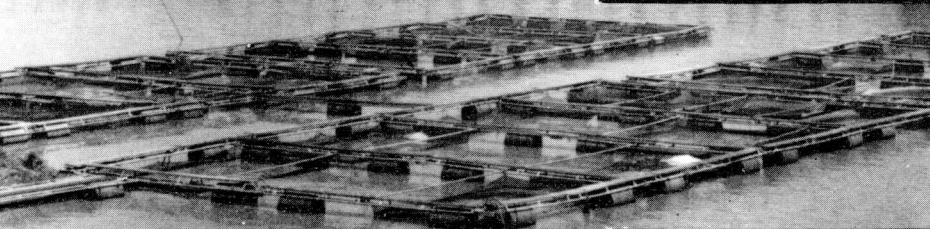
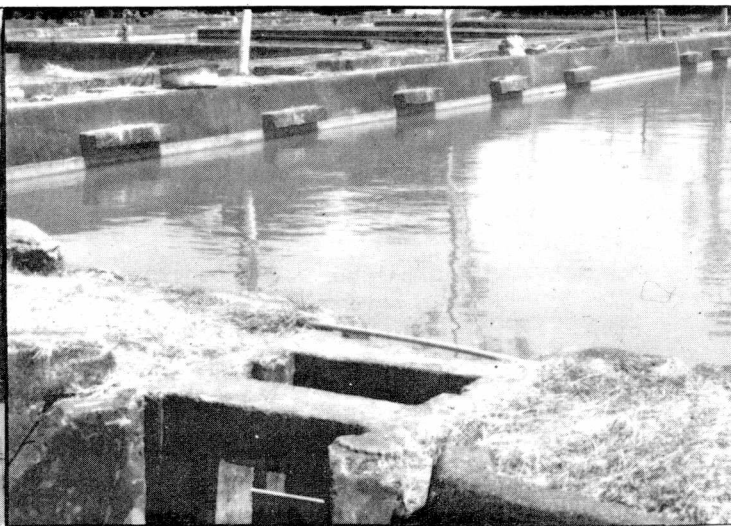
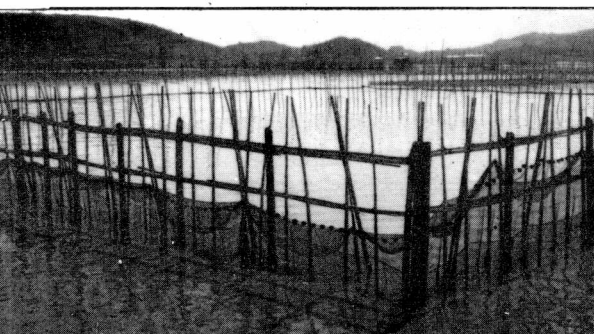
(48-77%), tilapia (9-68%) and common carp (5-20%). Tilapia and common carp tend to evade or by-pass the seine net resulting in low recovery at harvest.

- The total stocking density of 6.6 fish/m<sup>2</sup> was far from optimum during the culture period as final mean weights and daily growth rates of all species in polyculture did not vary significantly.

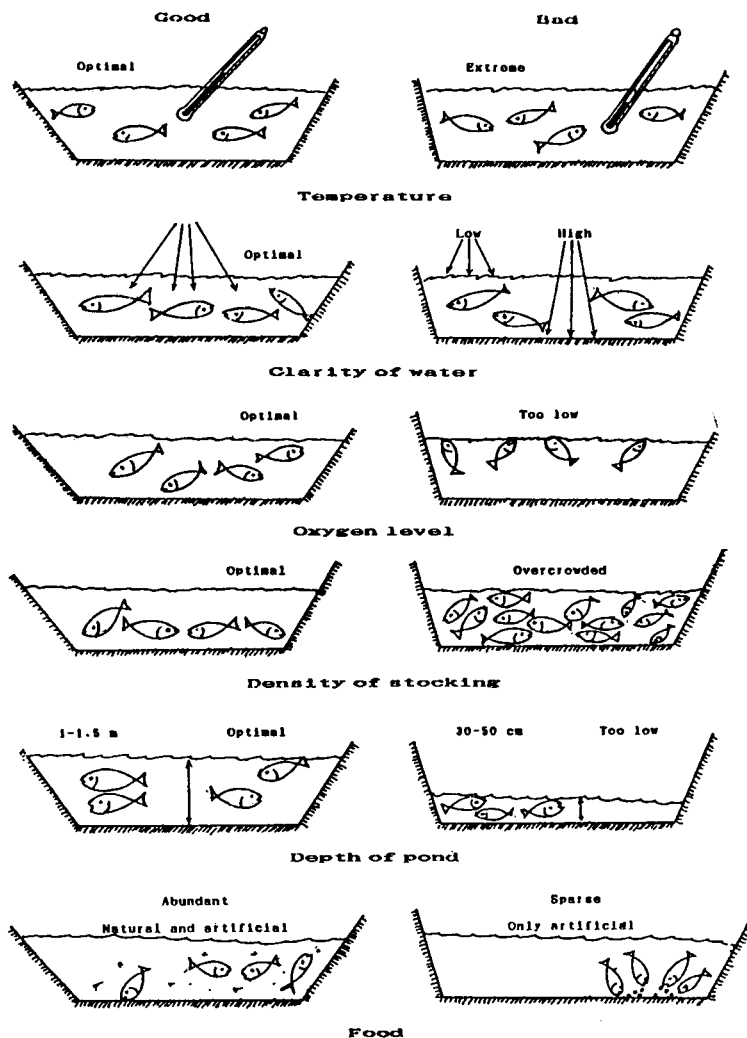
In a separate study, tilapia (*T. nilotica*) was grown in polyculture with different species of carps in cages at a total stocking density of 40 fish/m<sup>2</sup>. The stocking ratio was 30 tilapia: 3 silver carp :2.5 bighead carp : 2.5 grass carp : 2 common carp. Selective harvesting of 100 g tilapia (with replacement) was done at intervals of 3, 4 and 6 months. The following were the results:

- Selective harvesting with replacement of 100 g + tilapia after six months resulted in increased production of 189.9 kg/50m<sup>2</sup>

*to next page ...*



*Grow-out culture of carp can be done in earthen ponds and in floating cages and pens in lakes*



Proper  
broodstock  
management

### Broodstock Management ... from page 11

conditioned in the spawning tank prior to hormonal treatment.

- Selected breeders should be handled with care to prevent stress. Low dissolved oxygen levels should be avoided and a regular change of water in the holding tank is necessary. It is best to handle carp breeders using special net with a strong mesh. It should be open at both ends, the stiffed mouth opening should be about 30 cm in diameter and 1 meter in length. When one

end of the net is opened, the fish can swim out easily.

- A double hammock made of water proof canvas, attached to a wooden or any solid frame is very useful for the transport of the selected breeders to the hatchery. Broodstock transport can also be mechanized using hard plastic or fiberglass containers provided with compressed oxygen.

Source: Gonzal, A. 1995. *International Training Course on Freshwater Aquaculture and Aquaculture Management*. 1995.

### Carp culture cont ...from page 16

- Average growth rate was highest in bighead carp (4.2-5.5 g/day) followed by silver carp (3.3-5.0 g/day); common carp (0.2-0.3 g/day) and grass carp (0.12-0.15 g/day);
- Average net production of all species in

polyculture ranged from 6.76-8.69 kg/m<sup>2</sup>

The growth performance of bighead and silver carp was faster than tilapia and common carp.

Source: Tabbu, M.; M. Lijauco.; R. Eguia; and C. Espigadera. 1986. *Polyculture of bighead carp, common carp and Nile Tilapia in cages in Laguna lake*. *Fish. Res. J. Phil.* 11 (1-2) 13-20.



# Product Development

## Market depends on good processing

### Harvesting

Harvesting techniques are basically similar in all species in tropical countries while in temperate countries, winter season is given serious thought..

As winter season approaches the water temperature in the pond decreases, the carp stops feeding. The carp farmer then must prepare for harvesting considering also that carps are usually sold live. Prepare and check protective clothing, nets and holding tanks. Discuss with prospective costumers estimated time of delivery. If ponds are large, pre-netting is advisable for partial harvesting so some of the fish will already be sold before the pond is finally emptied.

It is relatively easy to harvest the rest of the pond; slowly drain the pond until the fish are in the catch-pit. The fish should then be removed by hand netting and transferred to oxygenated transport tanks. Harvesting must take place when the water temperature and air temperature are more or less constant, fluctuations should exceed 2°C either way. More drastic changes than this are stressful to the fish.

### Handling and processing

Fish producers recognize that the quality of the end product is as important as quantity making processing and marketing as important factors in any aquaculture industry. Carps like any other fish have to be processed to be attractive to the consumer considering that the fish have a lower commercial value than other species. Their bone structure makes them difficult to fillet.

Good processing produces whole carps and fillets with high quality at a reasonable price for consumers.

Water quality is important during the final stage of harvest

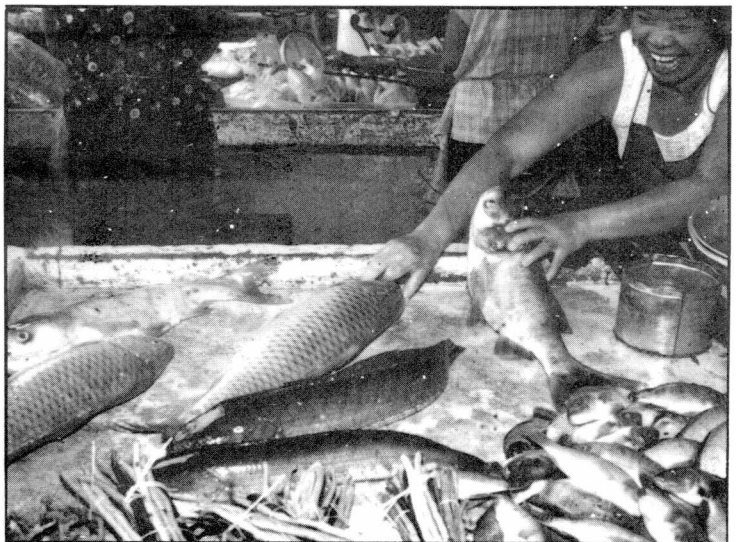
and during transportation to the processing plant because it can affect the hygienic and organoleptic quality of the fish.

In Western Europe small quantities of carps are sent regularly from the farms to processing plants so that the market is continuously supplied.

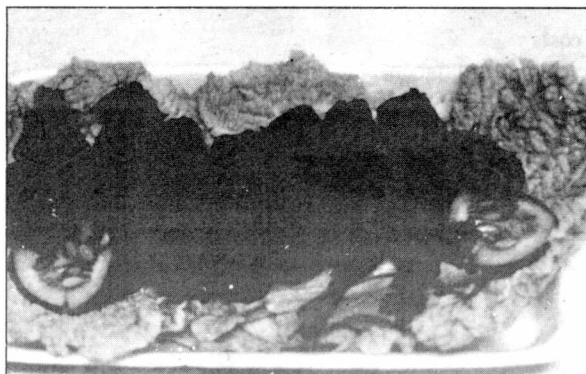
Carps are still traditionally sold live in the market and so they are harvested, sorted, stored and transported carefully. *Chinese carps are more fragile than common carp and require extra care.*

In the Philippines, common carp is usually filleted, cut into sticks, frozen, and used as breaded sticks. They are also bottled and canned in tomato sauce. Non-traditional smoked products like kippered dry-cured, cold-smoked ham, hot-smoked steaks, salami and sausages are developed from bighead carp. There is a standard procedure deboning of carp fillet similar to that of milkfish.

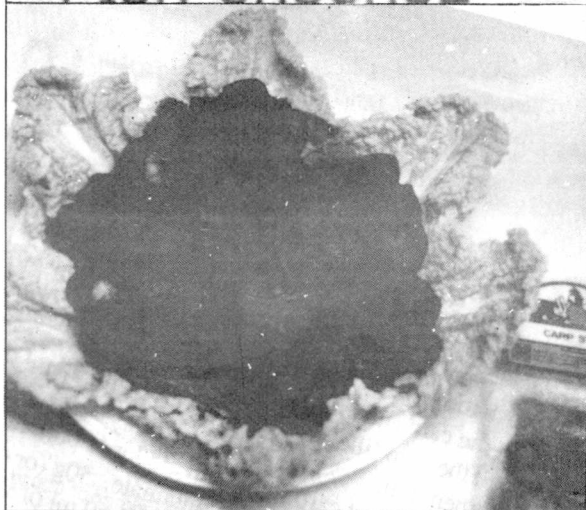
Convenience food products from bighead carp, the "ready to cook foods" are in great demand. They are prepared for fish sticks, fish spread, fish flakes, (plain and salted), fish powder (smoked and unsalted), smoked fish fillet, pickled smoked carp, ham-cured carp fillets and fish sausage.



*Carps are usually sold live in the market*



FISH SAUSAGE



## Products from bighead carp

### Preserving carp at home

Common carp (*Cyprinus carpio* L.), like any other fishes can be processed and stored for future use without changing its flavor, texture, and freshness. You can do this, by drying, smoking, wrapping in plastic bags and freezing.

Before drying however, soak the choice cuts of the fish in brine solution with spices for at least two hours.

You can also prepare the fish by pickling before drying. On drying, place the fish in a tray and expose under the sun for at least one day. Or you can use an artificial drier to remove the excess water from the fish's meat.

The fish is then smoked for about one and one-half to two hours until the skin turns brown.

After smoking, wrap the fish in plastic bags; then store in a freezer. This treatment preserves the fish for at least 128 days. If stored in refrigerating temperature, however, it will last only for 28 days. Carp intended for the table market should be held for 2-3 days in storage tanks which have a flow of water running through, this cleans their intestines and gills.

Sources: Billard, R. *The major carps and other cyprinids*. In: *Production of Aquatic animals: Fishes*. Nash, C.E. and A.C. Navotny. 1995. Amsterdam Elsevier. p. 21-54. *World Animal Science*, 8. (2) Michaels, V.K. 1988. *Carp fishing*. Farnham & Fishing News Books. 207 p. (3) *Times Journal*. June 1, 1976, p 17. (4) *Processing of bighead carp into food products*. Fisheries Technology Manual Series. No. 10. August 1991. Los Banos, Laguna, Philippines.

# Carp recipes

*preparing carps for the table and making a difference!*

*Carps are being served as a main course in restaurants in Eastern Europe. Preparing them is interesting because they are suitable for use in different dishes. In addition to the following recipes, carps are also delicious when smoked like any other fishes. You may try these European recipes:*

## **Baked carp**

*4 cross-cut pieces of carp  
4 oz sliced button mushrooms  
1 tablespoon chopped parsley  
half an onion, skinned and finely chopped salt and pepper  
1/4 pt red wine  
1/4 pt water  
1 level tablespoon cornflour*

### **Method:**

Soak the fish in salted water, rinse and wipe well. Put in a greased dish and add the mushrooms, chopped parsley, onion salt, pepper, wine and water. Cover with a lid or foil and bake in the centre of the oven for about 30 minutes, or until tender.

Remove the fish, spoon the mushroom mixture over it and keep warm. Strain and retain 1/2 pt of the cooking liquid.

Blend the cornflour with little cold water and stir in the cooking liquid. Put into a pan and bring the mixture to the boil, stirring all the time until it thickens. Cook for a further 1-2 minutes and adjust the seasoning if necessary.

Serve the fish coated with this sauce.

## **Stewed Carp**

*1 carp  
1/2 pt water  
1/2 pt port wine  
1 tablespoon of lemon pickle  
1 tablespoon of browning  
1 teaspoon of mushroom powder  
1 onion  
6 cloves  
horseradish root  
cayenne pepper  
a large lump of butter  
a little flour  
juice of one lemon  
time ; 75 minutes*

### **Method:**

Having scaled, cleaned and taken out the gills, wash the carp thoroughly by soaking it in water for 30 minutes and dry it in a cloth. Dredge a little flour over it, and fry until light brown.

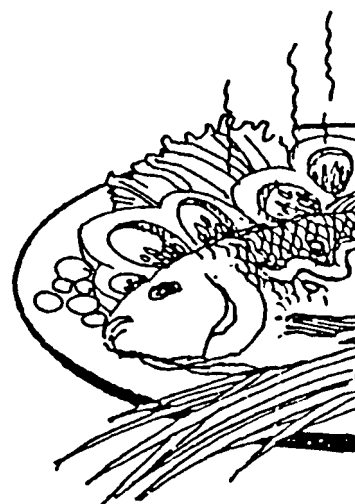
Put it in a saucepan with the port wine, water lemon pickle, browning, mushroom powder, horseradish root, a little cayenne pepper and the cloves stuck in the onion.

Cover the saucepan closely, so that the steam may not escape, and let it stew gently over a low heat until the gravy is reduced to just enough to cover the fish.

Remove the fish and place in a serving dish.

Reheat the gravy and thicken it with a lump of butter rolled in flour, then strain it over the fish and garnish with croutons.

Just before placing on the table, squeeze the lemon juice into the sauce.



## **Nuremburg carp**

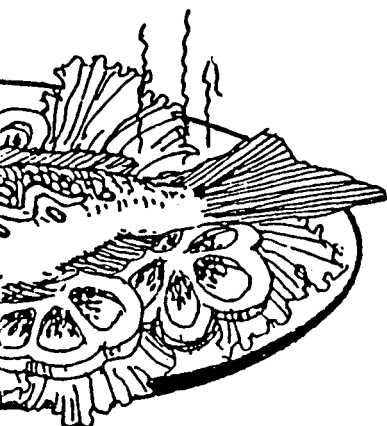
*carp  
salt and pepper  
plain flour  
horseradish or tartare sauce  
time: about 15 minutes*

### **Method**

Clean, fillet and dry the fish. Season, roll in plain flour deep fry in very hot fat until brown and crispy. Serve with horseradish or tartare sauce.

# Carp recipes

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## Blue carp (*Karpfen blau*)

1 large carp  
1 sliced onion  
a pinch of mixed herbs/  
peppercorns  
wine vinegar

### Method

Clean the carp on a wet surface and salt it on the inside only, so as not to disturb the slimy skin, which gives the 'blue' coloring. Tie the tail and head of the fish together to a circle. Place the fish in a large pan and cover with vinegar. Bring to the boil and add the sliced onions, herbs and peppercorns. Simmer very gently until the fish is tender but firm. Put on to a hot dish and serve with creamed horseradish sauce or browned butter containing capers and parsley.

## Carp with sour cream

1 carp  
4 new potatoes  
2 z butter  
1/2 pt sour cream  
1 oz breadcrumbs  
seasoning

### Method

Wash and dry the fish, but remove the head. Put a layer of thinly sliced potatoes at the bottom of the dish, season and cover with half the butter and half the cream. Bake for about 20 minutes. Place the fish on top and cover with the rest of the cream. Cook in the center of a moderate oven. Cover the fish with crumbs and continue to cook for another 10 minutes.

## Carpe farcie

carp  
a few mushrooms  
parsley  
an onion  
the hard roe of the carp  
2-3 yolks of hard boiled eggs  
2 anchovies  
salt and pepper  
minced parsley  
knob of butter  
time: 20-30 minutes according to size

### Method

Chop up the mushrooms, parsley, onion, and the hard roe of the carp (if it happens to have one). Half cook the mixture, and then mix it up with the yolks of hard boiled eggs, finely chopped anchovies, salt and pepper. If the roe is soft, mash it up and mix it in this forcemeat. Scale, open and clean the carp; stuff it with the forcemeat, and sew it up. Roll the carp in oiled paper and grill it. In a dish place some butter, blended with minced parsley, pepper and salt, and serve the fish upon it.

Source: Michaels, V.K. 1988. *Carp Fishing*. FANHAM & Fishing News Book s. 207 p.

## Paprika carp

2-3 sliced onions  
4 oz butter  
3/4 pt cream  
2 teaspoons paprika  
salt

### Method

Fry the onion lightly in the butter. Place the carp on the onions and add the cream mixed with paprika, salt and pepper. Bake until tender. Strain the sauce over the carp.

# Aquaculture clinic

**Q:** Carps are considered the most important group of fish for aquaculture and have been successfully introduced in regions where they are not native but why is it that the production is still mainly concentrated in China? How can production be improved in other countries?

**A:** The limited production of carps outside China is that the polyculture system, which is highly efficient from an economic point of view in China, is difficult to apply in other countries despite many efforts in this direction. There is no consistent written materials of Chinese technology for production, and the expertise of farmers in China is based on experience taught practically on the farm. Foreign trainees working in Chinese training centres cannot learn the technology well enough to apply it and pass the information on at home. Conversely intensive monoculture systems using pelleted feeds is rapidly becoming accepted and is now expanding in China.

Furthermore, carps have received limited interest as food in developed countries because of their poor marketing appeal. The interest is limited mainly to use carps for control of weeds and improve water quality.

But carps have great potential for meeting protein demands and food self-sufficiency. Most carp species are fully domesticated and production technologies are readily available, however, production is reasonably low, compared to other species.

The potential of carp production can offset or compensate for the decline of offshore and inland fisheries in many countries.

Carp culture is an ideal option to species which can greatly damage the environment because of the *in situ* recycling of wastes.

*Source: Nash, C.E. and A.J. Navotny. 1995. In: Production of Aquatic Animals: Fishes, Amsterdam Elsevier. p. 21-54. World Animal Science, CB.*

## Announcement to our Readers & Subscribers

SEAFDEC AQD Management decided to merge SEAFDEC Asian Aquaculture and Aqua Farm News for the following reasons: (1) readership of both publications are exactly the same; (2) the staff will be more focused and cohesive rather than working solely on their respective publications; (3) the merged publication will be of better quality and delays will be substantially reduced if not eliminated; and (4) the merged publication may easily be expanded in terms of readership.

The merged publications will be named SEAFDEC Asian Aquaculture since it has been in circulation much ahead of Aqua Farm News. The style, however, will follow that of Aqua Farm News because it is more popular and "friendly" to the readers. The format will be changed to depict "reimaging" of AQD to a more relevant and "industry friendly" institution consistent to our vision statement. June 1997 is the target date of the first merged issue.



## Thailand hosts SEAFDEC Program Committee Meeting

This year's program committee meeting was held in Phuket, Thailand on 12-15 November hosted by the SEAFDEC Training Department.

The Committee bared among others two major adjustments to the 1997 AQD Program of Activities: technology verification and on-site training.

The Committee also discussed the 3-year plan (1998-2000) of the Center involving the regular and collaborative programs on research,

training, and information proposed by each Department and the Secretariat.

AQD will implement research projects based on the results of the survey conducted in the region. Likewise, training activities will also be based on similar survey on training needs of the region. The survey replaces the seminar-workshop "Aquaculture Development in South-east Asia held every three years.

The Meeting was attended by representatives from Brunei Darussalam, Japan, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam and observers from Indonesia, Cambodia, as well as regional and international organizations.

## AQD Chief to trainees - improve fish productivity

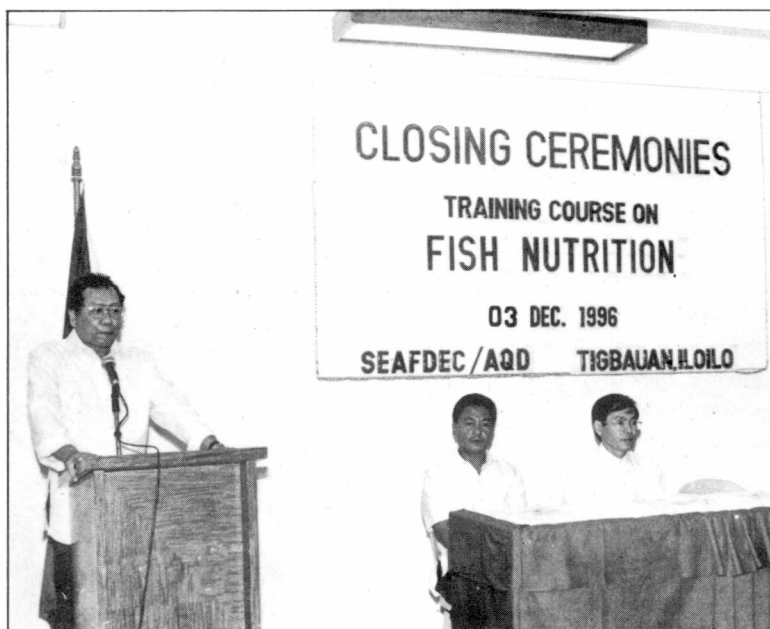
Dr. Rolando R. Platon exhorted the trainees of Fish Nutrition Course improve fish productivity in the region. The closing ceremonies of the course was held last December 3 at SEAFDEC's main station in Tigbauan, Iloilo.

Feeds and feeding constitute roughly about 50-60 percent of production cost in any aquaculture venture be it shrimp or milkfish. It is imperative that one knows the quality and availability of food in any culture system.

The six-week course (Oct. 23-Dec. 3, 1996) addresses the needs of aquaculture technicians and fish nutritionists for basic theoretical information and technical skills on aquaculture nutrition, be it natural food organisms or formulated pellet diets.

The participants were: four Filipinos, two each from Thailand, Malaysia, and Vietnam and

one each from Cambodia, Nepal, Iran and Brunei Darussalam.



*AQD/Chief, Dr. Rolado Platon addressing the trainees.*

*In this issue*

- Carp culture, p 1
- What's up on carp, p 2
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- What you should know about carp, p 6
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- Aquaculture clinic, p 22
- SEAFDEC News, p 23

AFN is a production guide for fishfarmers and extension workers. It discusses the technology for cultured species and other recent information excerpted from various sources.

In citing information from AFN, please cite the institutional source which is not necessarily SEAFDEC/AQD. Mention of trade names in this publication is not an endorsement.

**Editor: E. Aldon**

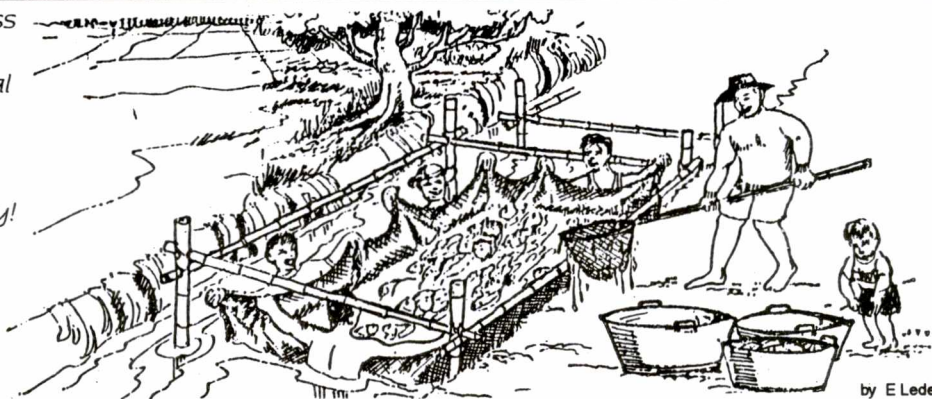
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This is it ... less inputs, less environmental stress and most importantly - money is easy!



by E Ledesma