# AQUACULTURE IN EGYPT: JUST A VISION OF DEVELOPMENT

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***Abstract***

Aquaculture is the aquatic counterpart of agriculture. Linguistically, it is derived from the Latin word "aqua" which means water, and "culture" which means to cultivate, or to till. Aquaculture is the husbandry of fish or other water-based species in a controlled environment (Molnar *et al.*, 1987). Historically, aquaculture was started in China about 500 BC and was practiced by the ancient Egyptians thousands of years ago. The ancient Egyptians depicted precisely its practices and drew different used fish species on the walls of their temples.

The world supply of fish comes from captive fisheries and aquaculture. Pillay (1990) argued that about 100 to 140 million metric tons of edible fish products will be urgently required to meet the demands of the world population by the year 2000. There is a deficit of approximately 20 to 60 million metric tons to be made up. The only known means to solve this problem is an accelerated development of aquaculture.

Aquaculture in Egypt represents about 47% of the whole Egyptian fish production amounted 724,407 metric tons (General Authority for Fish Resources Development, 2001:8). There is still a good opportunity to increase the Egyptian aquaculture production and challenge the future population demands. The Egyptian fish cage aquaculture may play an effective role in this concern. The Egyptian private aquaculture sector produces about 42% of the total Egyptian aquaculture production.

The main objectives of this study were: (1) to show aquaculture situation in the world; (2) to show aquaculture development in Egypt; and (3) to raise some visions and suggestions, for policy-makers in order to develop the Egyptian aquaculture industry.

## INTRODUCTION AND THEORETICAL FRAMEWORK

Aquaculture is the aquatic counterpart of agriculture. It is the husbandry of fish, or other aquatic species, in a controlled environment (Molnar *et al.*, 1987). Aquacul-

ture, compared to agriculture, was relatively ignored for some reasons.. Among those reasons were: (1) food in lakes and seas has, until recently, been abundant and there were no urgent needs to establish aquaculture industry; and (2) technical problems regarding breeding and egg hatching of many aquatic organisms were ambiguous, or mysterious. Those problems were probably, in part, due to the fact that man was dealing with organisms that were different from himself and in an environment, which he feared, and until recently did not understand.

Historically, aquaculture was started in China about 500 BC and was practiced by the ancient Egyptians thousands of years ago. The ancient Egyptians depicted and drew precisely practices of this art and different fish species used on the walls of their temples. The ancient Egyptian drew precisely, on the walls of their temples, different fish species used in this art including Nile Tilapia and Nile Perch. An antique fish pond with its internal nursery, from the era of the Roman empire occupation to Egypt, was discovered as a result of the excavation in Alexandrai at the end of 2001.

The world supply of fish comes from captive fisheries and aquaculture. The world catch of fish was approximately 4 million metric tons in the year 1900. This fish supply was increased to 20 million metric tons in 1930, then to 30 million metric tons in 1930, and to 70 million metric tons in 1970 (Molnar *et al.*, 1987). The world total fish production increased from 86,323,600 metric tons in 1985 to 96,925,900 metric tons in 1991. Reported world fish production contracted from a figure of 122 million tons in 1997 to 117 million metric tons in 1998 (Food and Agriculture Organization of the United Nations, FAO, 2000). This came mainly because of the effects of the climate anomaly, El-Nino, on some major marine fisheries. World fish production recovered in 1999 with an estimate of 125 million tons. The world fish production increase of 20 million tons over the last decade was mainly due to aquaculture (Food and Agriculture Organization of the United Nations, FAO, 2000).

In general, importance of aquaculture has been emphasized and increased for several reasons. Among those reasons: (1) aquaculture has been recognized as a good source of inexpensive and rich animal protein. In the past few decades, aquaculture was perceived as an available means to overcome malnutrition, famine, and similar related problems; (2) fish conversion ratio (production/ration) is the highest among all known domestic animal species including pigs, chicken, and cattle; and (3) accelerated aquaculture growth is the only known means to encounter the world increasing demands of animal protein.

## AQUACULTURE IN THE WORLD

The principal reasons for the development of aquaculture are, in general, the same as those reasons responsible for the development of any other known traditional activities. In general, as the world population and fish demands increase, aquaculture has the potential to be an increasingly important source of supply. Pillay (1990) argued that about 100 to 140 million metric tons of edible fishery product will be urgently required to meet the demands of the world by the year 2000. The world total catch of fish can not exceed the primary productivity of the total world aquatic bodies. In this sense, the total catch of fish cannot exceed at all 100 million metric tons a year. According to that estimation, there will be a deficit of approximately 20 to 60 million metric tons to be made up. The only major means known for solving this problem is an accelerated development of aquaculture.

The increasing pressure of the world population gives further dimensions to the problem of undernourishment and even starvation. McCraren (1994) claimed that aquaculture will be a major global industry of the twenty-first century. The expectation is based upon the world anticipated population growth and stable, or declining, captured fisheries harvest. Aquaculture production will have to increase seven folds in order to supply the expected world demand for fish by the year 2025.

In general, it is expected that the total world demand of fish in the year 2025 will be 156.5 million metric tons, 48% of them should be from aquaculture (Michigan State University Aquaculture Center, 1994). This estimate was based upon three assumptions: (1) per capita fish consumption remains steady at 1990 value (18.4 pounds); (2) population in the year 2025 will be 8.5 billions; and (3) wild catch of fish remains steady at 81.3 million metric tons (means of years 1985-1991).

From the previously mentioned points, it is obvious that the opportunity of aquaculture expansion seems to be significant as long as we are approaching the limit that can be harvested economically from the world oceans. This opportunity of aquaculture expansion looks good if the demand for human consumption will double, as predicted, by the year 2005. In addition, fishery scientists agreed that any further increase in the world catch is doubtful, gives present technology high energy cost, and changes badly characteristics of fishery resources.

For the two decades following 1950, world marine and inland capture fishery production increased on an average by as much as 6 percent per year, trebling from 18 million metric tons in 1950 to 56 million metric tons in 1969. During the 1970s and

1980s, the average rate of increase declined to 2 percent per year, falling to almost zero in 1990s. This leveling off the total world catch follows the general trend of most of the world's fishing areas, which have reached their maximum potential for capture fishery production, with the majority of fish stocks being fully exploited. Aquaculture production showed a steady growth ranging from 5 percent per year during the period 1950-1969, to 8 percent per year during the 1970s and 1980s, and has increased further to 10 percent per year since 1990. World capture fisheries and aquaculture production contracted from 122 million metric tons in 1997 to 117 million metric tons in 1998. World fish production recovered in 1999 with a total production of about 125 million metric tons. The production increase of 20 million metric tons over the last decade was mainly due to aquaculture production as the captured fishery production remained relatively stable (Food and Agricultural Organization of the United Nations, 2000). Table (1) showed world fish production per capita food fish supply. World fish production per capita food fish supply, according to table 1, was increased from 14.3 kilograms in 1994 to 15.4 kilograms in 1999. Table (2) showed top producer countries of marine and inland fishery production in 1998 led by China (17.2 million metric tons), and followed by Japan (5.3 million metric tons), and then the United States (4.7 million metric tons). Table (3) indicated major aquaculture production countries and the value in U.S. dollars in 1998 led by China (27.072 million metric tons).

Employment, as reported by Food and Agriculture Organization of the United Nations (2000), in capture fisheries and aquaculture production sector in 1998 was about 36 millions (about 15 million full-time, 13 million part-time, and 8 million occasional workers). Employment in aquaculture is estimated to account for about 25 percent of the total employment opportunities). China followed by India, Japan, Philippines, and Indonesia are the biggest world producers regarding aquaculture production.

Fichter (1988) argued that most people in the United States seldom think about food shortages because of the plenty of food available. The United States people vigorously consume about half of the resources available in the world every year. Fish consumption in the United States increased 30 percent between 1970 and 1981, and 47% of the fish consumed in 1981 was imported. Per capita consumption of commercial seafood in the United States reached 15.4 pounds in 1987 and exceeded to reach about 20 pounds by the year 2000. The catfish industry, which is the largest in the United States, experienced a 5% growth in 1990 and continued to grow in the year 2000.

Table 1. World fish production and per capita food fish supply during the period 1994-1999.

| Year | Fish production (million tons) | Per capita food fish supply (Kg) |
|---|---|---|
| 1994 | 112.3 | 14.3 |
| 1995 | 116.1 | 15.3 |
| 1996 | 120.3 | 15.8 |
| 1997 | 122.4 | 16.1 |
| 1998 | 117.2 | 15.8 |
| 1999 | 125.2 | 15.4 |

Source: Food and Agricultural Organization of the United Nations, FAO (2000).

Table 2. Top producer countries of marine and inland fishery production in 1998.

| Country | Production (million tons) |
|---|---|
| China | 17.2 |
| Japan | 5.3 |
| United States | 4.7 |
| Russian Federation | 4.5 |
| Peru | 4.3 |
| Indonesia | 3.7 |
| Chile | 3.3 |
| India | 3.3 |
| Thailand | 2.9 |
| Norway | 2.9 |
| Republic of Korea | 2.0 |
| Philippines | 1.8 |

Source: Food and Agricultural Organization of the United Nations, FAO (2000).

Table 3. Top producer countries of aquaculture production in 1998.

| Country | Production (million tons) | Value (U.S. dollars) |
|---|---|---|
| China | 27072 | 25449 |
| India | 2030 | 2223 |
| Japan | 1290 | 4126 |
| Philippines | 955 | 639 |
| Indonesia | 814 | 2150 |
| Republic of Korea | 797 | 766 |
| Bangladesh | 584 | 1494 |
| Thailand | 570 | 1807 |
| Viet Nam | 538 | 1357 |
| Other Countries | 4782 | 12448 |

Source: Food and Agricultural Organization of the United Nations, FAO (2000).

McCraren (1994) mentioned that a study conducted by the U.S. Department of Agriculture stated that the American aquaculture production in 1980 was 203 million pounds with a farm gate value of 192 million dollars. During the 1980s, aquaculture Production was quadrupled reaching an estimated 860 million pounds with a farm gate value of more than $760 million by 1990. Aquaculture production in the United States was 402,757 tons in 1988 with a value of $608,856,000. The estimate for 1991 was 543,770 tons with a value of $750,250,000. The United States aquaculture production level continues to increase but still about 3% of the world aquaculture production.

The United States policies have supported aquaculture industry. In 1978, the Farm Bill acknowledged applicability of aquaculture to the goals of the United States Department of Agriculture (USDA). At the same time, the United States Department of Commerce developed a plan for aquaculture in the country. The National Aquaculture Act of 1980 helped set the aquaculture policies of the United States. In 1987, the United States Congress passed a revised farm bill that included a section that established four regional aquaculture centers. In 1988, the United States Congress created a fifth center for aquaculture in the Northern Central Region. In 1993, two bills were introduced in the Congress. The first bill was to place all commercial aquaculture under the United States Department of Agriculture, and the second bill was to create marine aquaculture centers under the United States Department of Agriculture/Sea Grant Program.

McCraren (1994) claimed that aquaculture accounts for nine percent of U.S. seafood production compared to the world average of sixteen percent. In 1990, according to McCraren (1994), it was ranked the tenth in the world aquaculture production. Imported fish and shellfish accounted for more than sixty percent of the United States trade deficit, after petroleum and automobiles.

Despite the fact that there are different and inaccurate data published about the United States aquaculture, they all lead to the fact that the United States aquaculture is a growth industry and the whole data provide some indicators about the expansion trends in this industry. The potential for aquaculture industry in the United States is huge. Aquaculture is the fastest growing segment of agriculture in the United States. Growth in the United States aquaculture industry means job opportunities, development of rural areas, and increase per capita GNP. Dick and Harvey (1988) estimated that for every ten million additional pounds of catfish produced, there are 220 jobs opportunities created within the industry and 1100 related job opportunities outside the industry. In general, growth of the United States aquaculture industry has been sup

ported by three main elements: (1) good and appropriate policies; (2) feed and facility industry (hatching facilities, tanks, hormones, roads, marketing facilities, etc.); and (3) good and determined investors and active work labor.

The world fish production owes much to the activities of China. China accounts for 32 percent of the world total (Food and Agriculture Organization of the United Nations, 2000). China has reported a persistent increase in fish production and also in fish feed. Most of China's fish production is consumed domestically and principally for human consumption. There has been an increase in the Chinese aquaculture production that, in the present time, dominates China's production. In the Asian region, aquaculture has developed as a rural activity integrated into existing farming systems. It has helped rural citizens in their long fight against poverty and starvation. Aquaculture has been considered a unique cultural element in most of the Asian countries. It provides the population there with their needed daily food and helps them avoid unemployment.

## AQUACULTURE IN EGYPT

Amer (1990) argued that it is very difficult to rely upon only one source of data to have an accurate estimation for fish production in Egypt. This came as a consequence of continuous and rapid changes occurred in this field. On the other hand, it came also as a direct consequence of inter-organizational conflict relationship in this field. Those data collected formally by governmental organizations do not account for those fish quantities smuggled by fish producers, as a way to avoid paying taxes, through different illegal channels and outlets. Sadek (1990) estimated that at least 10-15% of the Egyptian fish production is not counted in the formal data documents. Some traditions of providing generous fish gifts, or Ashaa, for all workers and guests attended fish harvesting, aggravates this problem as it amounted for almost 10-15% of the production. Fish consumed by fishermen and their families are not accounted in the obtained formal fish production data. Mainly, General Authority for Fish Resources Development and the Central Authority for General Population Numeration and Statistics are considered the main two formal sources of the Egyptian fish production data. The two organizations always issue non-identical data in relation with fish production. In general, those obtained formal data can be viewed as only sheer indicators of the present trends in the Egyptian fish production.

Despite the fact that sea areas represents about 48% of the total Egyptian aquatic resources, they are not a rich source to rely on increasing fish catches. They produce only about 20% of the Egyptian fish production. On the other hand, probabil-

ity of increasing this percentage in the future is very limited. This limitation is due to the fact that Egypt is located in a very poor fish area of the Mediterranean and Red Sea areas. The Mediterranean and the north of the Red Sea, where Egypt is located, are very poor in its primary productivity. It became worse as a result that Egypt has no fishing fleets equipped with proper technologies.

The Egyptian annual population growth rates reached critical points in which they were higher than the Egyptian gross domestic product (GDP) during the year 1992/1993 and 1993/1994 (Faulks, 1997). The Egyptian population reached 61 millions in 1998 (49.1% females) with gross national income of $ U.S. 79.2 billions. The Egyptian population is expected to reach about 78.2 millions in 2015, and 92 millions in 2030 (The World Bank, 2000). Table (4) shows some of the Egyptian important economic indicators. Despite the fact that the Egyptian population growth rate was decreased to about 2.2 in 1997, population annual increase still represents a threat to the Egyptian development (Ali and Gamal El-Din, 1997).

In general, Egypt's population used to double nearly every fifty years from the beginning of the nineteenth century till the middle of the twentieth (Asaad and Wahba, 2000). After that, it started to double nearly every twenty-eight years (table 5). At the same time, the Egyptian resources did not double at the same rate. As a consequence, a gap was created between population growth and resources. Mohamed (1985) expected that in the first years of the twenty-first century, the total Egyptian food production will reach about 985 thousand tons of different meat products versus a consumption demand of about 1919 thousand tons of meat in the same year. In this sense, it is expected that there will be an expected gap between meat demand and supply of about 961 tons. Murad (1997:5) emphasized the same figure by warning against the increasing imports of animal meats from 95.2 million Egyptian pounds in 1984, then 405 million Egyptian pounds in 1983, followed by 1341.2 million Egyptian pounds in 1990, and then increased to 1989 million Egyptian pounds in 1994.

Egypt is considered as one of the largest world wheat importers. Egypt also imports about fifty percent of its needed food from outside its borders. The Egyptian cereal imports increased from 3,877 metric tons in 1974 to 8,580 metric tons in 1990. This came despite the food aid provided by the United States and other Western countries which increased from 610,000 metric tons in 1974-1975 to 1,210,000 metric tons in 1989-1990 (The World Bank, 1992).

Table 4. Some Egyptian economic indicators.

| Year | 91/1992 | 93/1994 | 95/1996 | 96/1997 |
|---|---|---|---|---|
| Population Growth | 2.80 | 2.20 | 2.26 | 2.2 |
| Real GDP Growth Rate | 1.90 | 2.90 | 4.90 | 5.1 |
| Unemployment | 9.20 | 9.80 | 9.40 | 9.3 |
| Inflation | 21.10 | 9.00 | 7.20 | 7.0 |
| Budget Deficit/GDP | 6.40 | 1.90 | 1.30 | 0.8 |
| Foreign Debt/Export | 89.50 | 58.00 | 49.20 | 44.0 |
| Exchange Rate (Le/US$) | 3.33 | 3.45 | 3.49 | 3.4 |

Source: Faulks (1997); * The World Bank (2000).

Table 5. The Egyptian population's during the period 1800-1996.

| Year | Population |
|---|---|
| 1800 | 2,488,950 |
| 1821 | 2,540,000 |
| 1846 | 4,500,000 |
| 1848 | 4,542,620 |
| 1872 | 5,210,287 |
| 1877 | 5,517,627 |
| 1882 | 6,804,000 |
| 1897 | 9,715,000 |
| 1907 | 11,287,000 |
| 1917 | 12,705,000 |
| 1927 | 14,218,000 |
| 1937 | 15,933,000 |
| 1947 | 19,069,000 |
| 1960 | 26,069,000 |
| 1985 | 48,000,000 |
| 1986 | 48,205,049 |
| 1988 | 50,700,000 |
| 1989 | 52,000,000 |
| 1994 | 57,000,000 |
| 1996 | 59,000,000 |

Source: Asaad and Wahba (2000:18).

The Egyptian external debts increased from 19.131 billion U.S. dollars in 1980, to 31.964 billion U.S. dollars in 1998. The Egyptian export value increased from $ U.S. 6.246 billions in 1980, to $ U.S.13.502 billion in 1998. The Egyptian import values increased from $ U.S. 9.157 billions in 1980 to $ U.S. 21.807 billions in 1998 (The World Bank, 2000). In addition, about 98.5% of the total Egyptian population live in almost 4% of the total Egyptian soil despite the fact that some new cities were constructed to absorb some of the Egyptian population. In the year 2000, the Egyptian wheat production reached about 6,654 metric tons, with total wheat consumption of 10,834 tons, and about 61.4% self sufficiency of wheat (Statistical Abstract/Central Authority for Public Mobilization and Statistics, 2001). The Egyptian situation is getting relatively a little better than 1993. Table (6) showed production, consumption, and self-sufficiency of foodstuffs in 1999/2000.

Table 6. Total Production, Total Consumption, and Self-Sufficiency of Some Important Foodstuffs in Egypt during the period 1999-2000.

| Foodstuffs | Total Production* | Total Consumption* | % Self-Sufficiency |
|---|---|---|---|
| Wheat | 6654 | 10834 | 61.4 |
| Rice | 5817 | 5380 | 108.1 |
| Maize | 6143 | 10855 | 56.6 |
| Beans | 334 | 417 | 80.1 |
| Potatoes | 1809 | 1619 | 11.7 |
| Onion | 1303 | 1197 | 108.9 |
| Peanut | 181 | 179 | 101.1 |
| Orange | 1637 | 1583 | 103.4 |
| Grapes | 1010 | 1009 | 100.1 |
| Fish | 649 | 857 | 75.7 |
| Meat | 691 | 911 | 75.9 |
| Poultry | 628 | 628 | 100.0 |
| Eggs | 182 | 182 | 100.0 |
| Sugar | 1412 | 1957 | 72.2 |
| Oil and Margarine | 606 | 979 | 61.9 |

Source: Statistical Abstract, Central Authority for Public Mobilization and Statistics (2001:27); * in 1000 tons

As the major source of income, Egypt is very relying on cash crop, oil exports, Suez Canal revenues, and hard currency banking deposits of the Egyptians working abroad. In general, those resources are vulnerable and liable to change and cut. This was obvious after the return of many Egyptians working in the Gulf area after the first and second Gulf Wars. There was a threat for more diminishing return after the attacks of 11 September on the United States. Explosive problematic situation in the area may aggravate the problem including that of the expected American aggression against Iraq and some other countries in the area.

Amer (1990) reported that despite the actual increase in the Egyptian fish production, which leap from about 142,000 metric tons in 1979, to about 256,000 metric tons in 1985, the Egyptian fish self sufficiency decreased from 80 percent in 1979 to about 78 percent in 1985. Amer (1990) claimed that there was a possibility of adding about 117,65 metric tons of fish to the Egyptian national production if aquatic resources and arable land can be successfully exploited in fish production. This can be achieved through an active aquaculture private sector which produces about 90 percent of the total activities in this field. Abdel-Fattah and El-Khatib (2000) reported that annual average of fish self- sufficiency per person during the period 1988-1998 was about 74%. This came, according to Abdel-Fattah and El-Khatib (2000), due to the fact that local consumption of fish during this period increased with 5.45% annually with an increase of fish local production with 5.11%, in addition to an increase of fish imports with 6.32% per year. Fish gap was estimated as 134.9 thousand tons / year and this gap increases annually with 6.45%. The Egyptian fish export reached only about 57 tons annually of the luxurious species (e.g., sea bream, shrimp, sea bass, and groupers) to cover fish imports of cheaper fish (e.g., Mackerel). In general, fish production sector contributes with about 6.4% of the total value of the Egyptian agricultural sector and about 15.4% of total value of the Egyptian animal production sector. The data obtained from the General Authority for Fish Resources Development (2001) showed that 957 tons of fish were exported, and 213,631 tons were imported during the year 2000. Fish/citizen ratio during the same year was 14.65 kilograms (came from fish imports and production). The Egyptian fish/citizen ratio per year changed from 10.15 kilograms in 1999 to 11.31 kilograms in the year 2000. Fish produced from the seas represented 18.06% of the total Egyptian fish production related to the year 2000. Table (7) showed aquatic resources and production of fish in the year 2000.

In general, the Egyptian fish production during the year 2000 encompassed 384,314 tons (53% of the total fish production) came from natural aquatic resources, and 340,093 tons (47% of the total fish production) came from aquaculture. The Egyptian fish production was increased from 246,000 tons in 1985 to 724,000 tons in the year 2000 (table 8). The Egyptian aquaculture production was increased from 33,000 tons in 1985 to 340, 000 tons in the year 2000 (table 9). Fish cage aquaculture production was increased from 1.92 tons in 1985 to 16,069 tons in the year 2000 (table 10). The Egyptian fish production that came from integrated rice-fish farming was increased from 5,500 tons in 1985 to 16,300 tons in the year 2000 (table 11).

The obtained fish data of the year 2000 indicated that Fish harvested from the Red and Mediterranean seas represented 18.06% of the total Egyptian fish production during that year; 19.49% of the total production from the northern lakes (Manzala, Borulus, Edco, and Mariout); 0.48% from the coastal lagoons (Bardawil and Port Fouad); 3.93% from the inland lakes (Qarun Lake, El-Ryan Lake, Lake Nasser, Mura & El-Temsah Lakes, Tushka, and El-Wadi El-Gadid ); 11.09% from the Nile and its branches; 46.95% from aquaculture (1.21% from the governmental fish farms, 41.26 from the private fish farms, 2.22% from fish cages, and 2.26% from the integrated rice-fish farming.

Table 7. The Egyptian fish production for the year 2000.

| Source | Production/ton | Percentage |
|---|---|---|
| Mediterranean Sea | 54,872 | 7.57 |
| Red Sea | 75,972 | 10.49 |
| Manzala Lake | 74,132 | 10.23 |
| Borulus Lake | 51,768 | 7.15 |
| Edco Lake | 8,922 | 1.23 |
| Mariout Lake | 6,378 | 0.88 |
| Bardawil Lake | 3,300 | 0.46 |
| Port-Fouad | 141 | 0.02 |
| Karoun Lake | 1,819 | 0.25 |
| Al-Ryan | 1,876 | 0.26 |
| Nasser Lake | 16,812 | 2.32 |
| El-Mura & Temssah Lakes | 5,786 | 0.8 |
| Tushka | 2,200 | 0.3 |
| The New Valley Resources | 15 | 0.002 |
| The Nile and its Branches | 80,321 | 11.09 |
| Governmental Fish Farms | 8,769 | 1.21 |
| Private Fish Farms | 298,895 | 41.26 |
| Floated Cages | 16,069 | 2.22 |
| Integrated Rice-Fish Farming | 16,360 | 2.26 |
| Total | 724,407 | 100.00 |

Source: General Authority for Fish Resources Development (2001).

Table 8. The Egyptian fish production during the period 1985-2000.

| Year | Production/ton |
|---|---|
| 1985 | 246,000 |
| 1986 | 268,000 |
| 1987 | 286,000 |
| 1988 | 306,000 |
| 1989 | 323,000 |
| 1990 | 339,000 |
| 1991 | 345,000 |
| 1992 | 347,000 |
| 1993 | 357,000 |
| 1994 | 368,000 |
| 1995 | 407,000 |
| 1996 | 432,000 |
| 1997 | 457,000 |
| 1998 | 546,000 |
| 1999 | 649,000 |
| 2000 | 724,000 |

Source: General Authority for Fish Resources Development (2001).

Table 9. The Egyptian aquaculture production during the period 1985-2000.

| Year | Production/ton |
|---|---|
| 1985 | 33,000 |
| 1986 | 33,000 |
| 1987 | 33,000 |
| 1988 | 33,000 |
| 1989 | 39,000 |
| 1990 | 35,000 |
| 1991 | 35,000 |
| 1992 | 35,000 |
| 1993 | 35,000 |
| 1994 | 35,000 |
| 1995 | 41,900 |
| 1996 | 54,600 |
| 1997 | 66,500 |
| 1998 | 113,200 |
| 1999 | 191,100 |
| 2000 | 340,090 |

Source: General Authority for Fish Resources Development (2001).

## THE EGYPTIAN AQUACULTURE AND DEVELOPMENT

Development is the process of improving the quality of human lives. It is conceived as a multidimensional process involving changes in social structure, attitudes, and institutions as well as the acceleration of economic growth, the reduction of inequality, and eradication of absolute poverty. It's the change of unsatisfactory conditions to satisfactory ones (Todaro, 1985). Development should encompass three inseparable components: (1) life-sustenance, (2) self-esteem, and (3) freedom, or liberation. Life sustaining needs include shelter, health, food, and safety. It also includes rising per capita income, elimination of absolute poverty, more employment opportunities, and lessening income inequality. Self-esteem is the feeling of authenticity, dignity, honor, self-reliance, and recognition. Freedom is the liberation of servitude and expanded range of choices.

From the previously mentioned points, development should have three components: (1) increasing the availability and widening distribution of basic life subsistence goods, (2) raising levels of living, and (3) expanding range of economic and social choices. Development should involve three interrelated societal activities: (1) the establishment of increased wealth and income as a perceived attainable goal for the broader masses of a society, (2) the creation and/or selection of adequate means to attain this goal, and (3) the restructuring of society to ensure persistent and continuous economic growth. People concerns should be given first priority in all development strategies.

Table 10. Fish cage aquaculture production in Egypt during the period 1985-2000.

| Year | Number of Fish Cages | Fish Production (in tons) |
|---|---|---|
| 1985 | 8 | 1.92 |
| 1986 | 32 | 26.82 |
| 1987 | 399 | 80.32 |
| 1988 | 394 | 28.57 |
| 1989 | 876 | 2143.94 |
| 1990 | 1541 | 4434.07 |
| 1991 | 543 | 1171.78 |
| 1992 | 354 | 245.08 |
| 1993 | 355 | 339.92 |
| 1994 | 509 | 956.78 |
| 1995 | 560 | 1977.48 |
| 1996 | 758 | 1719.60 |
| 1997 | 1009 | 2103.00 |
| 1998 | 1294 | 2855.30 |
| 1999 | 3153 | 12885.00 |
| 2000 | 4288 | 16069.00 |

Source: General Authority for Fish Resources Development (2001)

Table 11. Integrated rice-fish production in Egypt during the period 1985-2000.

| Year | Area (in 1000 feddans)* | Total Fish Production (in 1000 tons) |
|---|---|---|
| 1985 | - | 5.5 |
| 1986 | 297.1 | 22.0 |
| 1987 | 409.4 | 22.0 |
| 1988 | 444.8 | 28.0 |
| 1989 | 535.3 | 25.0 |
| 1990 | 479.1 | 25.0 |
| 1991 | 412.8 | 25.0 |
| 1992 | 435.2 | 25.0 |
| 1993 | 429.8 | 19.0 |
| 1994 | 359.8 | 18.0 |
| 1995 | 411.2 | 19.9 |
| 1996 | 297.4 | 21.3 |
| 1997 | 137.8 | 6.9 |
| 1998 | 233.6 | 12.4 |
| 1999 | 242.0 | 10.0 |
| 2000 | 215.0 | 16.3 |

Source: Food and Agricultural Organization of the United Nations, FAO (2000).

*Feddan = 4200m2 .

People should be involved in any development projects, from the beginning till and after the accomplishment of development objectives. Aquaculture provides Egypt with the opportunity to exploit more arable lands and increase fish production. It is a way of stretching the Egyptian population from the Nile Delta to other not-exploited and not inhabited areas. It is considered also as a way of land reclamation. Aquaculture is also recognized as a way to fight some epidemic diseases including Bilharzia that has dominated the Egyptian rural areas for thousands of years. Black Carp (*Mylopharyngodon piceus)* can be used effectively in eradicating snails from irrigation canals and the Nile estuaries. This impact is due to the fact that black carp can eat snails, the main hosts of Bilharzia. Grass Carp (*Ctenopharyngodon idella*) is used in getting rid of aquatic weeds from irrigation canals. It is a means of biological control. This advantage may be conceived as one of aquaculture positive contribution in maintaining a good and healthy environment.

In general, aquaculture can play an effective role in the Egyptian Development for some reasons. Among those reasons: to increase food production (animal protein), to decrease fish imports and save precious hard currencies, to generate job opportunities, to develop rural Egyptian communities, to attract individuals to work in some new arable areas, to play a role in land reclamation, to help resist some epidemic diseases, to help raise standard of livings for poor citizens, to achieve relatively self reliance development strategy based upon citizen' participation, to have a sense of self-esteem among citizens, and to attract students and scholars to specialize in aquaculture education. In this sense, aquaculture may coincide with all the previously mentioned development strategies.

General Authority for Fish Resources Development, the sole organization responsible for aquatic resources, led different national campaigns directed mainly towards increasing fish production including integrated fish-rice campaigns that cover all the Egyptian governorates, and aquatic weed control campaign implemented in cooperation with the Egyptian Ministry of water resources and irrigation.

The Egyptian government has provided aquaculture sector with enough means of success including, conducting aquaculture training programs for citizens to study and exchange different experiences in this field, constructing enough number of fish hatcheries, sending scholars abroad in long-and short term training programs, providing private sector with incentives to participate in this field, and financing some high agricultural schools to introduce aquaculture courses in their curricula.

Most of the Egyptian aquaculture are basically from the first, second, and third levels with an average production of 6,00-1,000 kilograms/feddan/year. Fish cage aquaculture in Egypt may play a revolutionary role with production of 50 kilograms per each cubic meter of water. In a small math calculation, a feddan of fish cage aquaculture may produce ten times its equivalent of traditional aquaculture under the Egyptian circumstances. The Egyptian aquaculture includes also intensive and semi intensive aquaculture. Some high aquaculture techniques are used including raceways, circulatory systems, mono-sex tilapia culture, tank aquaculture, crayfish culture, and cage aquaculture. The Egyptian private aquaculture sector helps introduce advanced aquaculture techniques and procedures. The Central Laboratory for Aquaculture Research of the Agricultural Research Center is involved in enriching aquaculture research and extension activities. Different Egyptian universities took part in developing aquaculture research. Some international aquaculture organizations (e.g., The World Fish Center, ICLARM) initiated its research activities in Egypt. In order to develop this field of aquaculture, some elements should be taken into consideration: (1) stable policies and regulations that mainly support positive activities in aquaculture, (2) easy and clear administrative procedures that facilitate this industry, and (3) active and easy reached extension role.

## VISION FOR THE EGYPTIAN AQUACULTURE

1. Egypt should have a vision of its aquaculture future. Vision is the philosophy, or principles, or strategies from which goals are stemmed, or derived. It is the final result, or the end purpose of the country's development processes. It is the desired accomplishments in term of societal improvement. This vision comes from the country's recognition of its problems, the gap with other countries and between rich and poor within the country itself. It represents the country's views of the ways taken for raising the standard of living for its citizens. It also reflects ideologies, beliefs, values, and the country perceived development strategies;

2. Egypt emphasized an approach in which development is integrated with humanistic perspectives. It is the type of development that aimed at raising the standard of living for all citizens. Development, in the Egyptian notion, means more education, more jobs, more health care, and more food for all citizens. In general, Egypt should have a clear and stable policies stemmed from its vision. Contradictory and unstable policies may lead to a disaster in aquaculture. Long run stabled policies and regulations may provide some incentives and trust for private sectors and investors to start and increase their aquaculture entrepreneurs. Disruptive actions taken by the government

may be reflected in destructive results. Harmonious and positive inter-organizational relations, based upon coordination and integration, in aquaculture may have a positive impact towards enriching this industry. Disruptive inter-organizational policies may lead to conflict and destruction of the industry;

3. Egypt should believe in the harmonious and integrated combination between indigenous and exogenous technologies. In this sense, indigenous knowledge related to aquaculture should be taken into consideration. A center for collecting aquaculture indigenous knowledge should be established in order to maintain and develop the rich experiences inherited by the common fish farmers since the ancient Egyptian Pharaohnic era. The destruction of numerous fish cultures as a way to construct Teraat El-Sallam (El-Sallam Irrigation Canal) that will reach Sinai Peninsula caused damaged the non-recorded legendary aquaculture indigenous knowledge. Researcher should lead the leap to collect this inheritance. Egypt should obtain appropriate technologies to increase aquacultural productivity. The required appropriate technologies should be selected based upon different factors including actual economic, social, and cultural factors, as well as the range of available technologies. Selected appropriate technologies should keep the environment clean and do not cause damage to the environment. Maintaining cultural values should be taken into consideration as a factor in evaluating and selecting appropriate technologies;

4. Governmental policies and regulations can assist in building up local technological capacity through education and Research. Establishing scientific research bases including the Central Lab for Aquaculture Research in Abbassa /Sharkia Governorate, introducing aquaculture curricula in agricultural high schools and universities, conducting long and short term training for researchers and extension agents to have access to positive experiences, providing international aquaculture organizations with facilities to initiate their activities in Egypt, and encouraging private aquaculture consultation firms to work are good steps in enriching the Egyptian aquaculture industry. The Egyptian aquaculture sector has suffered tremendously from the conflicting policies conducted by different ministers and governorates. For example, in 1992, fish cage aquaculture industry in Damietta Governorate was almost eradicated completely by a strange decision taken by the Ministry of Water Resources and Irrigation, by that time, with an excuse of polluting the aquatic resources there without looking for solutions and alternatives. Successful experiences like aquaculture projects in Kafrel-Shikh Governorate should be copied and imitated in other governorates. Emphasis on marketing extension in Kafrel-Shikh Governorate should be perceived as a necessity for developing aquaculture there.

Importance of aquaculture marketing extension should be emphasized in this industry;

5. Egypt should take a lead in developing its aquaculture extension strategies. Aquaculture extension should be based upon qualified extension agents, appropriate and enough extension facilities, satisfying rewarding system for extension agents, and a true belief in extension value. General Authority for Fish Resources Development lack appropriate and effective extension system. General Authority for Fish Resources Development has enough number of aquaculture specialists but most of them lack the capability and information to work as extension specialists. Highly qualified aquaculture extension agents should come as one of top priorities of the organization. Training programs in extension should be conducted and an active extension staff should be formed to play its role. It is of utmost importance to seek help from the Agricultural Extension and Rural Development Research Institute. Extension consultants can play a role in this regard. Enough support should be moved faithfully towards this vital element. Extension and knowledge transferred are conducted mainly in the present, by efforts of private sector consultants and individuals who view aquaculture as a good investment;

6. Egypt should take a step towards constructing marine fish hatcheries and marine cultures in order to cope with the increasing demands of the Egyptian population and increasing fish exports;

7. Egypt should stop the unstable and irresponsible policies that led to diminishing of its rich inland lakes including Manzala, Mariott, and Idco lakes. Strong policies and strict regulation should stop firmly polluting the Egyptian lakes and aquatic water resources. Fishermen, and their families, should take enough and human care instead of abolishing their main source of living. Policies of changing aquatic lake lands into plant cultivation areas should be firmly stopped;

8. Agreements with other countries should be conducted in order to allow the Egyptian fleets to fish overseas in rich fishing areas; and

9. General Authority for Fish Resources Development (GAFRD) should lead related national campaigns directed toward solving those problems of aquaculture based upon priorities and needs (e.g., damping industrial pollutants in aquatic resources, low fish hatcheries' capacities, low collected number of natural mullet fry, and the epidemic widespread of crayfish in the Egyptian water resources and cultivated areas).

Those suggested campaigns should recruit all aquaculture and environmental experts in this concern to find best solutions available for this problem regardless of their affiliation with the Egyptian Ministry of Agriculture. Non-governmental organizations and volunteers may play an active role in this concern. Irresponsible and irrelevant media mania made by some top officials affiliated with GAFRD should be halted completely. Researchers, fish statisticians, environmentalists, volunteers, different governmental and non-governmental organizations, and fish production experts should play an active role in leading the suggested aquaculture campaigns.

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# الإستزراع السمكى فى مصر : مجرد رؤية تنموية

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** *باحث أول ، المعمل المركزى لبحوث الأسماك بالعباسية ، مركز البحوث الزراعية .*

إستهدفت هذه الدراسة وبصفة أساسية محاولة إستشراف رؤية تنموية لقطاع الإستزراع السمكى المصرى من خلال نظرة تحليلية شاملة للإستزراع السمكى فى العالم ، وكذلك الإستزراع السمكى فى مصر متضمنة تطورة وفلسفته التى يسير على نهجها ، وكذلك دوره في عمليات التنمية ، وفلسفة الدولة التى تنتجها فى هذا الصدد ، ثم محاولة وضع توصيات عملية يمكن رفعها إلى المسئولين واضعى السياسات بهذا القطاع بغرض الإستغلال الأمثل للإمكانيات المتاحة وتحقيق الأهداف التنموية التى تتضمنها سياسة الدولة والمتمشية مع فلسفة العمل بهذا القطاع .

ترتكز هذه الدراسة وبصفة رئيسية على تحليل مضمون تلك البيانات المنشورة والصادرة من قبل كل من منظمة الأغذية والزراعة التابعة للأمم المتحدة ، والهيئة العامة لتنمية الثروة السمكية ، وهى إحدى هيئات وزارة الزراعة المصرية والمسئولة الأولى عن تنمية الثروة السمكية فى البلاد ، هذا بالإضافة الى تلك البيانات الصادرة عن البنك الدولى وكذلك الآراء المنشورة لنخبة من الخبراء والباحثين فى هذا القطاع .