# SHRIMP FARMING

# Nicaragua

# 2001

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# I- INTRODUCTION

Despite early recognition of Nicaragua's tremendous natural resources and potential for aquaculture, it wasn't until 1988, with a study funded by the FAO, that a primary evaluation was made of estuarine areas on the Pacific Coast suitable for aquaculture. The results of this study indicated that an area of approximately 39,250 hectares was appropriate for development. Of the total, 72% of the hectarage was located on the Estero Real/Gulf of Fonseca estuary system and the rest was distributed on land near the Aserradores and Padre Ramos estuaries, and on the Tamarindo River on the Pacific Coast: all in the western part of Nicaragua. Areas with less potential also exist on the rest of the Pacific Coast.

These figures were verified by a second study carried out in 1992, but it wasn't until 1994, with funding from (EU) European Union , that a more detailed study was completed. The objective of this study was to determine the carrying capacity of the Estero Real in order to develop a land use policy to protect the environment and mitigate the potential negative environmental impact of aquaculture on the system. The results indicated that the Estero Real is a non-stratified estuary, with sufficient volume of water exchange to allow the development of around 18,000 hectares of ponds, without major effect on the ecosystem and mangrove growth.

Nicaragua was a relative latecomer to the shrimp culture scene, although it had the highest potential for aquaculture development in Central America. During the first half of the 80's there were a few isolated initiatives in extensive culture on salt flats and impoundment systems, but these were abandoned because of political instability and technical problems. It wasn't until 1987 that a few cooperatives, with bank financing and technical assistance from the National Fisheries Administration (INPESCA), put 100 hectares of rudimentary ponds into production. Since then, the number of cooperatives increased and by 1990, cooperatives had a total of 1000 hectares in production, yielding 250 pounds per hectare per year (lbs./ha/yr.)

Starting in 1990, within the framework of a new market economy and faced with the growth of aquaculture on a worldwide level, national and foreign investors became interested in shrimp culture. Investors began to request land concessions that today total 21,351 hectares on the Estero Real, of these, 5,920 were extended to cooperatives and 15,431 were given to commercial enterprises. From a total of 21,351 hectares, commercial enterprises have a total of 5,480 hectares in production, whereas cooperatives a total of 3,049 hectares in production.

At the beginning of 1998, there were 8,299 hectares in production: 759 were under production using rudimentary systems; 1,872 using an extensive system and 5,668 were producing using a semi-intensive system. However, after the October devastation caused by Hurricane Mitch, the hectares in production were reduced by 25%, representing a loss of 2,108 producing hectares.

The infrastructure loss affected all systems, large farms as well as cooperatives. The severity of the damage depended on the location of the farm site. The farms located on the interior (eastern) part of the Gulf of Fonseca estuary system were more affected than those farms located nearer the Gulf. Obviously, the quality of the farm infrastructure also influenced the extent of the damages. The appraised damage can be divided in the following way: commercial sector (non-cooperative investment) lost 1,212 hectares, representing damage to 22% of this sector. Cooperatives lost 896 hectares, which translates into 40% of the hectarage cultivated by cooperatives at that time. In terms of the effect by culture system intensity, 86 hectares damaged were rudimentary systems (11% of all such systems), 569 hectares lost were extensive (30% of all extensive systems) and 1,453 hectares lost were semi-intensive (26% of all semi-intensive systems.)

For the last few years (from 1994 – 1998), shrimp culture grew at a rate of over 150% annually, however in 1999, shrimp culture declined due to the combined effects of Mitch and the White Spot Viral infection. 2001 production levels were 8.8 million pounds, from which only 7.4 millions pounds were exported with a value of US$21,262,975; a 30% fall in exports from 1998 levels.

# II- Shrimp Culture in the National Economy

## 2.1 Gross National Product

The Fisheries and Aquaculture sector contribution to the Gross National Product has increased from 0.27% of the total in 1990 to 24.6% in 2001. Shrimp culture's contribution alone has grown from 1.1% of GNP in 1994 to 3.7% of GNP in 2001, reaching the highest peak in the year 2000 with a contribution of 5.1%(US $ 31,000,000) of GNP.

## 2.2 Exports

Shrimp culture production grew from 2.2 million pounds in 1994 to 8.8 million pounds in 2001, with an annual average increase in the last five years of 150%. However, in 1999, shrimp culture production decreased 30% in value, and 28% in export volume, because of the smaller areas cultivated due to the combined effects of Hurricane Mitch damage and decreased productivity caused by White Spot Virus.

In 2001, 8.8 million pounds were exported with a value of US$21.3 million. The average export price also showed a slight fall in relation to average prices obtained in 2001 US$2.90/pound FOB in 2001 compared to US$4.10/pound FOB in 2000.

Cultured shrimp represented 6% of total exports of Nicaragua in 1998, 4.3% in 1999, 5.1% in 2000 and 3.7% in 2001 . Cultured shrimp also grew from accounting for 14% of total fisheries exports in 1994 to 30% in 1998, but fell to 22% in 1999, and went up again to 30% in 2000, finishing at 24.6% in 2001.

Fisheries and aquaculture production occupied second place among the principal exports of the country. In 1990, exports reached a total of 2.4 million pounds with a value of US$9.2 million and in 2001, fisheries and aquaculture represented 21.2 million pounds with a value of US$88.3 million.

# III- CURRENT SITUATION

## 3.1. Production Area

9,351 hectares are now in production, of which 1,123 are operated under completely rudimentary systems, 2,634 under extensive systems, 5,592 under semi-intensive systems and 2 has under closed zero exchange system. Cooperatives control 3,619 hectares (38.7%) of the total area in production, and private farms, 5,732 hectares (61.3%).

The average production of the rudimentary farms was 250 pounds of whole shrimp/hectare/cycle of three growing months, enabling the possibility of two cycles per year, taking advantages of tidal activity in the rainy season for lack of pumping equipment.

Extensive production systems had harvests averaging 600 pounds of whole shrimp/hectare/cycle, completing two cycles per year. In the year 2001 semi-intensive systems showed an average of 1,200 pounds/ hectare/cycle, however, not all of the hectarage was worked both cycles, a great percentage was worked only intermittently during the year.

**PRODUCTION VOLUME**

| (Pounds) | | | | |
|---|---|---|---|---|
| **Year** | **Subsistence** | **Extensive** | **Semi-Semi Intensive** | **Total** |
| 1991 | 156,453 | 0 | 0 | **156,453** |
| 1992 | 181,756 | 0 | 320,000 | **501,756** |
| 1993 | 162,370 | 0 | 546,973 | **709,343** |
| 1994 | 167,250 | 697,400 | 1,475,496 | **2,340,146** |
| 1995 | 145,290 | 1,198,900 | 3,726,000 | **5,070,190** |
| 1996 | 192,800 | 1,447,800 | 4,065,050 | **5,705,650** |
| 1997 | 113,200 | 1,780,000 | 4,987,364 | **6,880,564** |
| 1998 | 460,953 | 1,548,775 | 6,834,742 | ***8,844,470** |
| 1999 | 168,250 | 781,800 | 5,382,950 | **6,332,987** |
| 2000 | 723.000 | 2,953,000 | 8,099.151 | **11,775,151** |
| 2001 | 769,675 | 3,143,641 | 8,622,021 | **12,535,339** |

* Note: Values by system are approximate.

## 3.2 Production of Laboratory Post-Larvae (seed)

There are four larval grow-out laboratories in Nicaragua, with a production capacity of six to eight million post-larvae/month. There is also one laboratory with a closed cycle production capacity of 15 to 20 million post-larvae, but which currently functions as a larval grow-out laboratory using imported nauplii from El Salvador and Panama.

The price of laboratory post-larvae oscillates between US$4,000 and US$4,500/million. Some farms also import post-larvae from neighboring countries like Costa Rica, Panama, Mexico, Venezuela and the United States.

Usually about 40% of the area in production is seeded either with larvae from national laboratories or with imported seed. However, with the White Spot situation these past years, the use of lab post-larvae has diminished, staying at 22% of the industry total. The cooperatives continue using 100% wild seed, produced by about 6,000 seed collectors (larveros). 90% of the species used *is Pennaeus vannamei (Litopennaeus vannamei*) with a price that varies between US$1,000 and US$2,000/million for wild seed.

## 3.3 Culture methods

In Nicaragua, the culture of marine shrimp began on a rudimentary level and later evolved extensive and semi-intensive methodologies.

**a.) Rudimentary Culture**

Use of impoundment areas prevails under this type of system; these vary in size from a few to hundreds of hectares. When an abundance of seed is detected in the surrounding waters, weir gates are opened to allow the water to enter, and then they are closed, enclosing the water and its high concentration of seed. The shrimp seed is allowed to grow to maturity

relying on the natural productivity of the water. Some farmers add caught larvae, but the seeding density is always very low (2.5 pl/$m^2$). Water exchange depends on the tides and the harvests are low, the production varying between 100 and 1000 pounds per hectare per year. The production costs are also low, and range between US$0.70 to US$1.20/pound of live shrimp. This system represented 12% of Nicaraguan production in 2001.

**b.) Extensive Culture**

These ponds are better built, generally of 20 hectares or more. Pumping equipment is used to maintain water levels and replace evaporative losses or filtration (leakage), maintaining minimum conditions of salinity, oxygen, etc. Yield depends on the natural productivity of the water, which is maintained by the use of inorganic fertilizers. Post-larvae are obtained from the wild and seeded directly in the grow-out ponds, at a density of 6 to 8/$m^2$. The culture period is about 120 days. This system represents 28.2% of the production in Nicaragua in 2001.

**c.) Semi-Intensive Culture**

Some producer use the nursery pond phase. The size of the grow-out ponds is reduced to 5 to 20 hectares. The seeding densities vary between 10 and 25 pl/$m^2$, when direct seeded. Diet is complemented with balanced feed, and oxygenation is improved with a higher daily water exchange rate that varies between 10% and 20%. The costs of construction lie between US$9,000 to US$14,000 per hectare. Shrimp productions levels are found between 1,100 to 5,000 pounds per hectare per year. The production costs vary between US$2.00 and US$2.50/pound of live shrimp, if wild seed is used and between US$2.50 and US$3.00, if lab seed is used. This system represents 59.81% of the total production in Nicaragua in 2001.

# IV- AVAILABILITY OF RAW INGREDIENTS

## 4.1 Feed.

Currently industrial quantities of feed are not made in Nicaragua and feed is imported from various companies located in other Central American countries, South America and the United States. The installation of a feed production plant would lower the operating costs of shrimp farms, as this constitutes the largest single operating cost of the predominating semi-intensive system. Prices vary between US$18.00 and US$30.00/100 pound sack; CIF in Managua, depending on the quality and protein percentage.

## 4.2 Fertilizers.

The fertilizers used on the shrimp farms are the same used in general agriculture: "18-46-0"and "0-46-0." There are no national supply problems. The price per 100 pound bag of 18-46-0 oscillates around US$14.50 and that of urea, around US$8.00, placed on the farm. Other fertilizers, more appropriate for shrimp farms are still not easily obtained on the local market.

## 4.3 Disinfectants

The lime used as a disinfectant is the agricultural/industrial type. There are no problems with local supply. The price of agricultural lime is US$3.00/100 pounds and that of Calcium Carbonate is US$1.05/l00 pounds.

## 4.4 Fuel.

The Estero Real lacks industrial electricity, so pumps use diesel motors. Currently there are no problems obtaining fuel in the country, however, there are no large storage facilities in the area and each producer is obligated to transport fuel to his farm. This is the second highest cost input in semi-intensive farm systems in Nicaragua. The price for a gallon of diesel, put on the farm, was US$1.70.

## 4.5 Ice.

There is still not a sufficient supply of ice in the area, despite the existence of two ice producing plants. At harvest, some producers must buy ice in cities as distant as Managua, 170 km. away from the farm. The price of ice, put on the farms, can be as high as US$2.20/100 pounds.

## 4.6 Processing Capacity

There are 20 processing plants extant in the country, with different levels of processing capacity, eight of them are located in the Pacific area, distributed in the following manner: three processing plants in the Chinandega area, one in Carazo and four in Managua province. All of the plants located in Chinandega province are certified by the HACCP system by the Ministry of Agriculture and Forestry (MAGFOR).
The installed capacity of the processing plants in the west is principally oriented toward processing whole shrimp or shrimp tails, fresh or frozen. The raw material freezing capacity in the Pacific area is 210,000 pounds, and in Chinandega is 130,000 pounds, with a 24 hour freezing capacity of 194,000 pounds in all of the Pacific, and in Chinandega, 120,000 pounds. The final product storage capacity is 970,000 pounds for the entire pacific and 400,000 pounds in the Chinandega area. Ice production each 24 hours is 364 metric tons for the entire Pacific and 180 metric tons in the Chinandega area.

# V- COMMERCIAL ORIENTATION

The traditional principal export market has been the United States, with 89.3% of the total in 2001, followed by Europe which currently accounts for 4.7% of total exports, particularly Spain, Italy, and France. Other destinations are Canada: 1.5%, Honduras 1.4%, Taiwan 1.3%, Ecuador 1.1%, China 0.3% and Guatemala 0.1%.

# VI- DEVELOPMENT STANDARDS

## 6.1 Policies/Incentives

Currently tax exemptions exist on the import of machinery, equipment and raw materials; or in their absence, the producer may solicit a rebate of 1.5% of the value (FOB) of exports, sheltered by Article 35 of the Commercial Tax Law (Ley de Justicia Tributaria y Comercial)

## 6.2 Legal Decrees

According to Law Number 290, of June 1998, the regulating agency for fisheries in the country is the Ministry of Commercial and Industrial Promotion (MIFIC), through its bureau: the National Fisheries and Aquaculture Administration (ADPESCA). Its authority extends throughout Nicaragua and its offshore limits.

Access to salt flats is obtained through land concessions, which are extended by ADPESCA. The term of the concession is thirty years, which can be renewed for an equal period immediately and successively and has an annual leasing cost equivalent to US$30.00 per hectare of land assigned.

Currently the Legislative Assembly is considering a Fisheries and Aquaculture Law Proposal which sets forth a system of public auction for land to be used for aquaculture and an annual standing price of US$30.00 per hectare. Another proposal for the laws regulating fees for the fisheries sectors is also in the works, to re-evaluate the US$30.00/ha yearly fee.

## 6.3 Economic Decrees

There are no economic or financial decrees specific to this industry.

## 6.4 Environmental Issues

The environmental standards that govern aquaculture are based on the recommendations of the Estero Real Resource Management Study, biological factors and ways to promote investment in the area.

These decrees contemplate measures such as: the prohibition of intensive culture systems, introduction of exotic species, cutting of mangrove to the depth of 200 meters bordering the estuary and use of chemicals that affect the environment, among others.

Estuaries for intake and drainage are determined in the contracts of each concessionaire to avoid contamination between neighboring farms and assure the sustainable development of aquaculture.

The Law of Environment and Natural resources, approved in 1996, mentions in one of its articles that before construction shrimp farms need an Environmental Impact Study, which should be submitted to the Environment Ministry (MARENA) for approval. Rule 45-94 "Regulation of Permits and Environmental Impact Evaluation," Article 5 provides the authority for the obligatory Environmental Impact Study for shrimp farms.

The Basic Law for Regulation and Control of Pesticides, Dangerous Toxic Substances and Others, regulates the use of controlled substances in the environment.

## VII- INVESTMENT INCENTIVES

Incentives for foreign investment are outlined in the Law of Foreign Investment, which guarantees the free repatriation of capital and profits and establishes arbitration, local as well as international, to protect the rights of interested parties. Foreign investors may shelter their investment, registering the same in the Central Bank and signing a contract of Foreign Investment with the Ministry of Economy that sets the obligations and rights of both parties.

## VIII- SANITATION CONTROLS

Some shrimp farms have initiated and put into practice Best Manufacturing Practices and a Sanitation Plan anticipating the execution and implementation of a HACCP plan. All of these adopt standard sanitation measures such as disinfecting with quick lime, sodium hypochlorite or organic iodine. Microbiological analysis of the post-larvae are also carried out before seeding and during harvest, as well as control of disease by application of antibiotics authorized by the Ministry of Agriculture and the FDA of the United States.

## IX- PRODUCER ORGANIZATIONS

The cooperative shrimp farms projects are socially organized involving community members of the area around the Project. These cooperatives are organized under statutes and recognized by the General Bureau of Cooperatives of the Ministry of Labor. These cooperatives possess a Board of Directors and a coordinator who represents them. The majority have grouped themselves in Unions and Federations:

The Regional Union of Shrimp farming Cooperatives (URCOCAM), with 3 cooperative members,
The Union of Aquaculture Practices Cooperatives (URCOOPRA), with 3 affiliated cooperatives,
The Regional Union of Aquaculture and Subsistence Fisheries Cooperatives (URCOPANIC), counts 12 affiliated cooperatives.
The Regional Union of Western Cooperative Shrimp Farms (UNICAMH), counts 47 cooperatives.
The Regional Union of Shrimp farming Cooperatives UPROCAN, counts 15 cooperatives.
The Regional Union of Shrimp farming Cooperatives UCER, counts 6 cooperatives.
The Regional Union of Shrimp farming Cooperatives UCOFRAR, counts 3 cooperatives.

The first three unions are grouped together in the Federation of Subsistence Fishermen (FENIPESCA).
There are about fifty cooperatives which are not affiliated with any Union, however, not all of these are in production.
There are approximately twenty commercial producers and of these 11 (about 64% of the area in production) are members of the Nicaraguan Aquaculture Association (ANDA.)

## X- TRAINING/RESEARCH

There was no training center for aquaculture at the start of the industry. Because of the growth of aquaculture, national universities have made an effort to offer training in this field to related science professionals as well as to cooperative producers. The University of Central America (UCA) first introduced this subject area as part of its agriculture major. Later, the University of Mobile and the National Autonomous University of Leon (UNAN, Leon) joined UCA in offering coursework in this area.

## 10.1 Center for Shrimp Research (CIDEA-UCA)

UCA is also beginning to offer a major in aquaculture systems, and has a Research Center for Aquatic Ecosystems (CIDEA-UCA), which was begun with funding from the Cooperative Agency of Japan (JICA). This center has, on the principal campus, a laboratory for water analysis, a plankton analysis laboratory and is currently mounting a beginning pathology laboratory. Starting in early 2000, a PCR for detection of White Spot virus should be in place. The center also has a feed laboratory to carry out research in nutrition and prepare feed on a small scale. There is also a wet lab for thesis research.

Besides offering technical assistance to cooperatives, the center offers research, formal and informal training to the aquaculture industry. The Center also offers laboratory services to aquaculture producers.

Through an inter-institutional agreement of ADPESCA/UCA-CIDEA, the CIDEA has a research farm located in Puerto Morazán to carry out research and training projects for students and cooperative members. This farm includes a Training Center, where training seminars are carried out for the cooperatives.

# XI- PROBLEMS AND/OR CHALLENGES

**a.) Financial problems**

The development of shrimp culture requires large credit resources from the financial system for itself as well as related ventures; however, financial intervention has serious limitations.

1. The fiscal standards of the Superintendent of Banks requires that a financial institution can not risk more than 15% of its capital on any one venture and commercial banks have stretched their purses near to the permitted limit because of their reduced capital level, between US$3.0 and 6.0 millions.

2. Long term financial investment programs at favorable interest rates do not exist; those that do are earmarked by the government for agriculture sectors, with emphasis on small and medium producers.

3. Bank creditors insist that producers present real guarantees worth at least 150%of the value of the loan, as well as provide 20% of the total investment. The bank does not accept the land concession as a guarantee, nor does it accept as guarantee the projected value of the harvest.

**b.) Problems with Infrastructure**

The problems with access to the farms become more serious every day because of the bad roads, which worsen during the rainy season on taking out harvest or bringing in raw materials. Potable water systems and sewage systems do not exist in the different towns around the Estero Real. Latrines are used that drain directly into the estuary without any previous treatment, contaminating the area with bacteria or any other microbiological contaminants, which may prove to be a problem in the future.

**c.) Legal Problems**

Producers' legal standing is unsure as there is no formal legislation related to shrimp farming/aquaculture on a congressional level. The General Law of Fisheries and Aquaculture has been approved generally in the National General Assembly, but has not been approved in all its line items and this makes shrimp farming legally subject to administrative and ministerial decrees as opposed to laws of a more formal, democratic nature.

**d.) Technical Problems**

The most serious technical problem that faces shrimp farming is pathological: diseases like Taura syndrome and White Spot virus, and above all, the fact that the country does not have a complete laboratory to detect shrimp disease. There is a need to train personnel and develop adequate infrastructure in this area.

# XII- CONCLUSIONS

Shrimp culture's impact in Leon and Chinandega Provinces, in terms of generation of jobs and money, is an alternative to the disappearance of cotton farming. The employment generated by shrimp culture is transforming a marginal sector into part of the economic development of the country.

Cooperative, national and international investors are interested in shrimp culture development in Nicaragua due to the tremendous national resources appropriate for aquaculture.

The profitability of shrimp farms has been amply proved in other countries, so financial resources for aquaculture production systems can be obtained from regional and international financial organizations that have experience in this area.

The development of shrimp culture in the Estero Real would be greatly helped if the government guaranteed the repair of the economic infrastructure of the area.

## XIII- RECOMMENDATIONS/PERSPECTIVES

The strengthening of the legal standing for shrimp farm investments is needed; the lack of approval of the Fisheries and Aquaculture Law leaves all legal decisions on an administrative level.

More attention must be paid to infrastructure requirements, economic (roads, docks, sewage/sanitary drains, potable water, etc.) as well as social (schools, health care, public housing and others). The area devoted to shrimp culture is one of the poorest of the country, and the development of aquaculture has attracted a large population that is living in precarious conditions, whose needs are beyond the possibilities of private investors.

Environmental Ministry (MARENA) in coordination with industry should continue to apply measures to protect the environment and guarantee the sustainability of shrimp aquaculture.

## XIV- REFERENCES

This document was based on information originating with

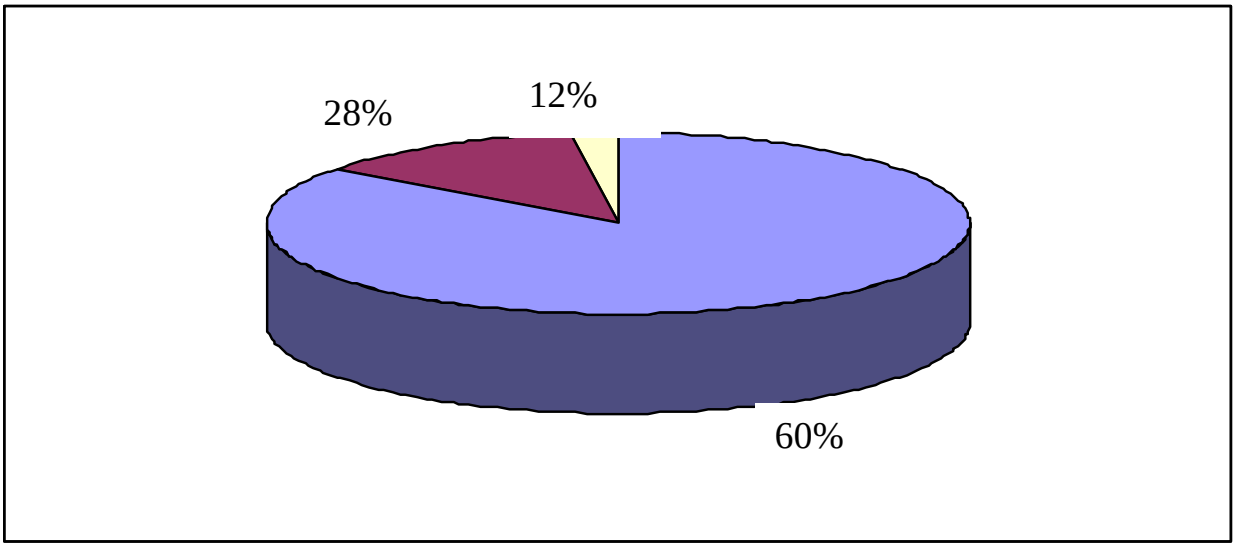
- Central Bank of Nicaragua (BCN)
- Center for Fisheries Research (CIRH)

- Conversations with members of the Environmental Ministry (MARENA),
- Members of the Ministry of Agriculture and Forests (MAGFOR)
- Members of the Aquaculture Administration (ADPESCA)

- Also from direct information from the Cooperatives, compiled by personnel from the Center for Shrimp Research of the University of Central America (CIDEA-UCA)

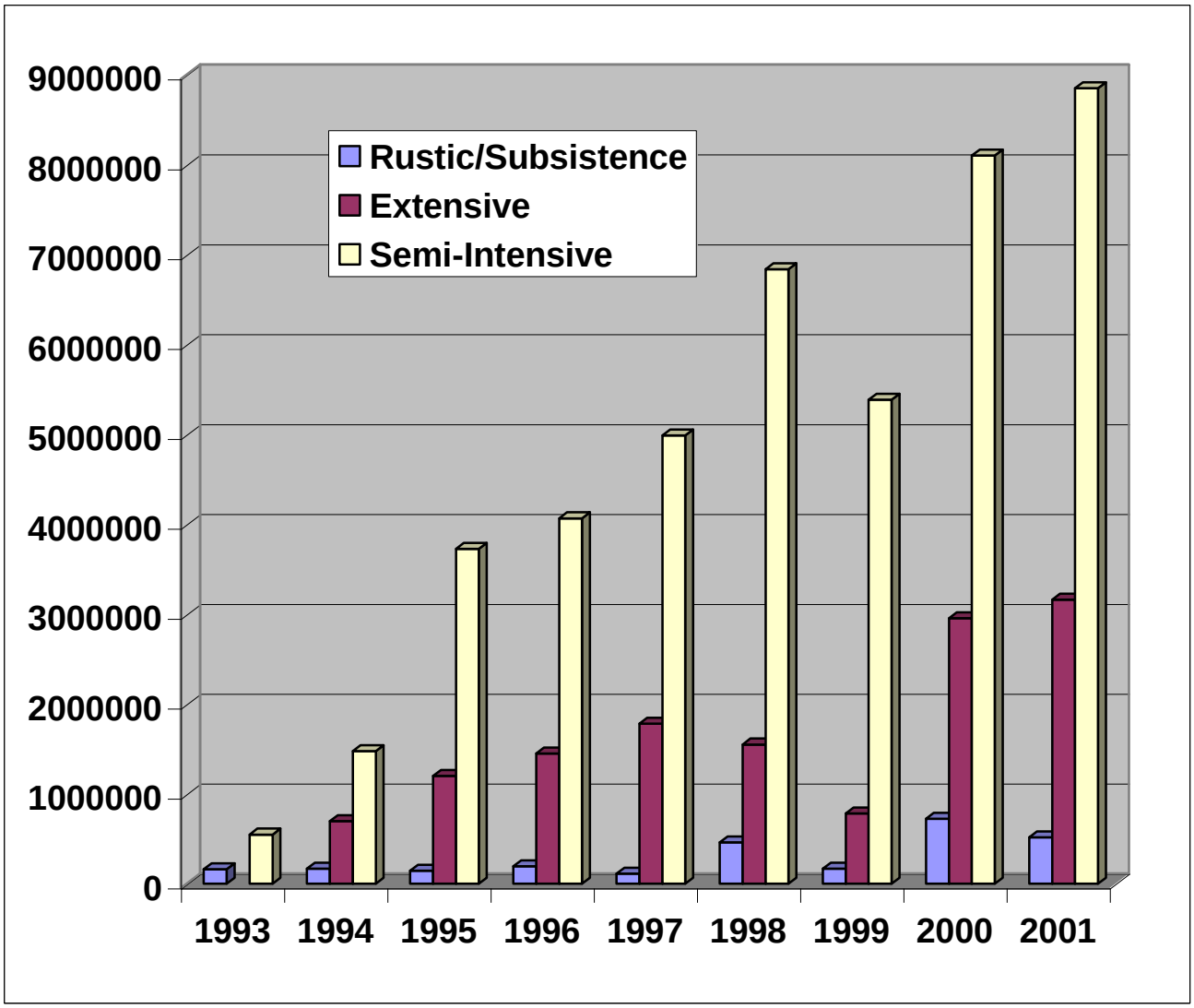
- From direct communication with producers, especially Mario Callejas, and the presidents of the Unions of Shrimp Cooperatives.

# PRODUCTION SYSTEMS

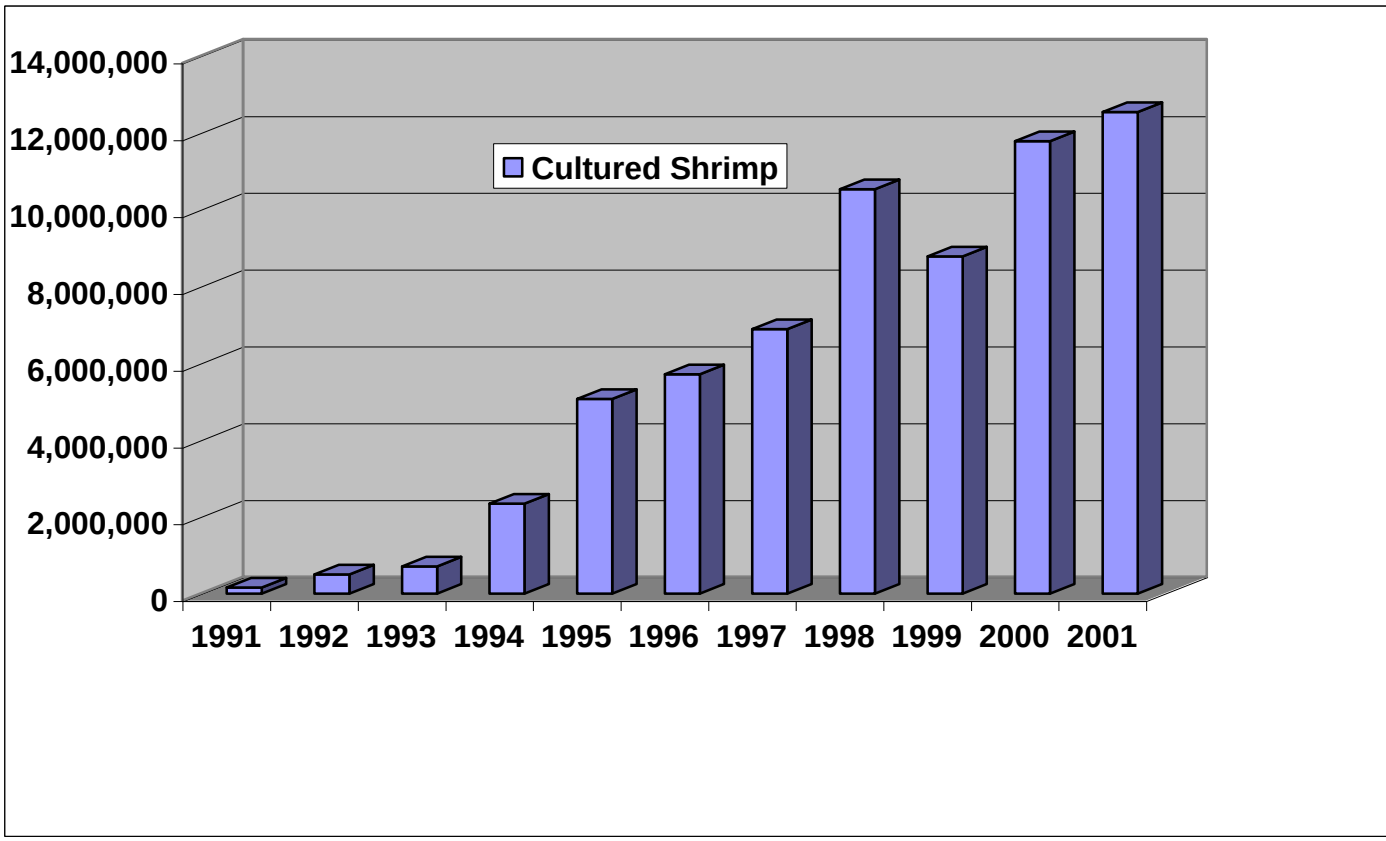



| | |
|---|---|
| **Semi-Intensive** | **85.14%** |
| **Extensive** | **12.3%** |
| **Rudimentary** | **2.3%** |

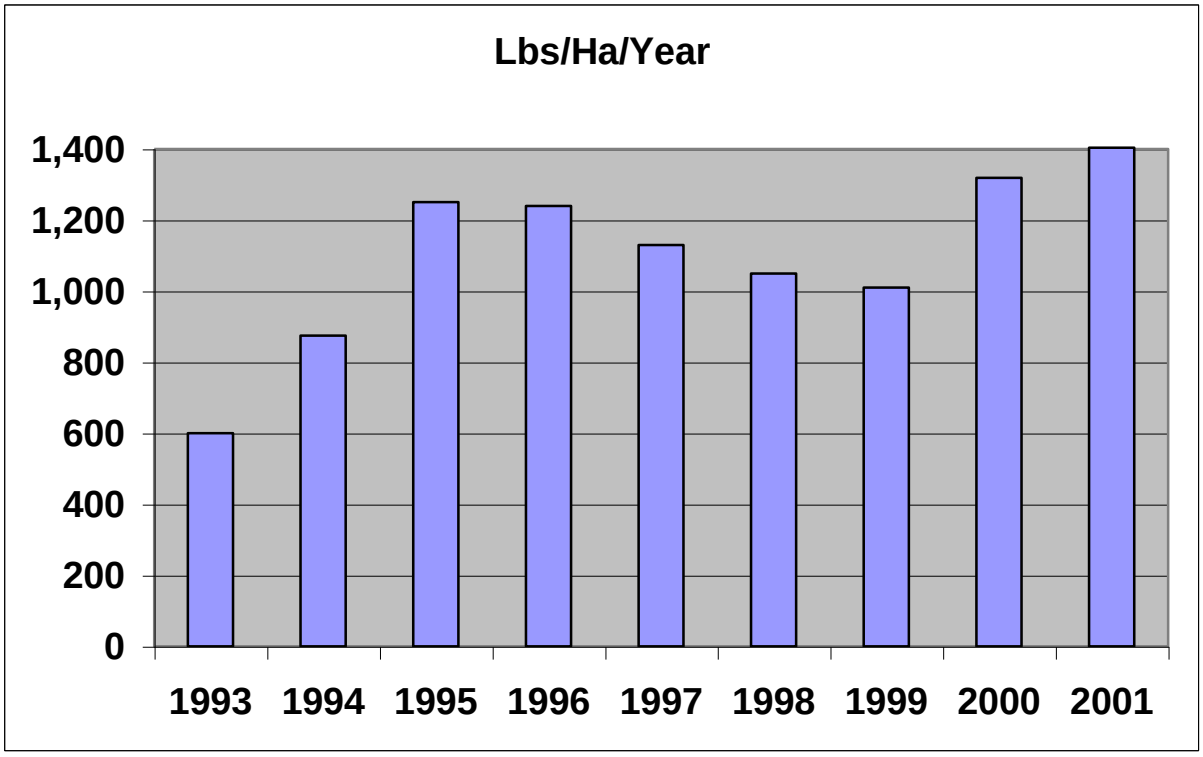
# PRODUCTION BY SYSTEM (Pounds)



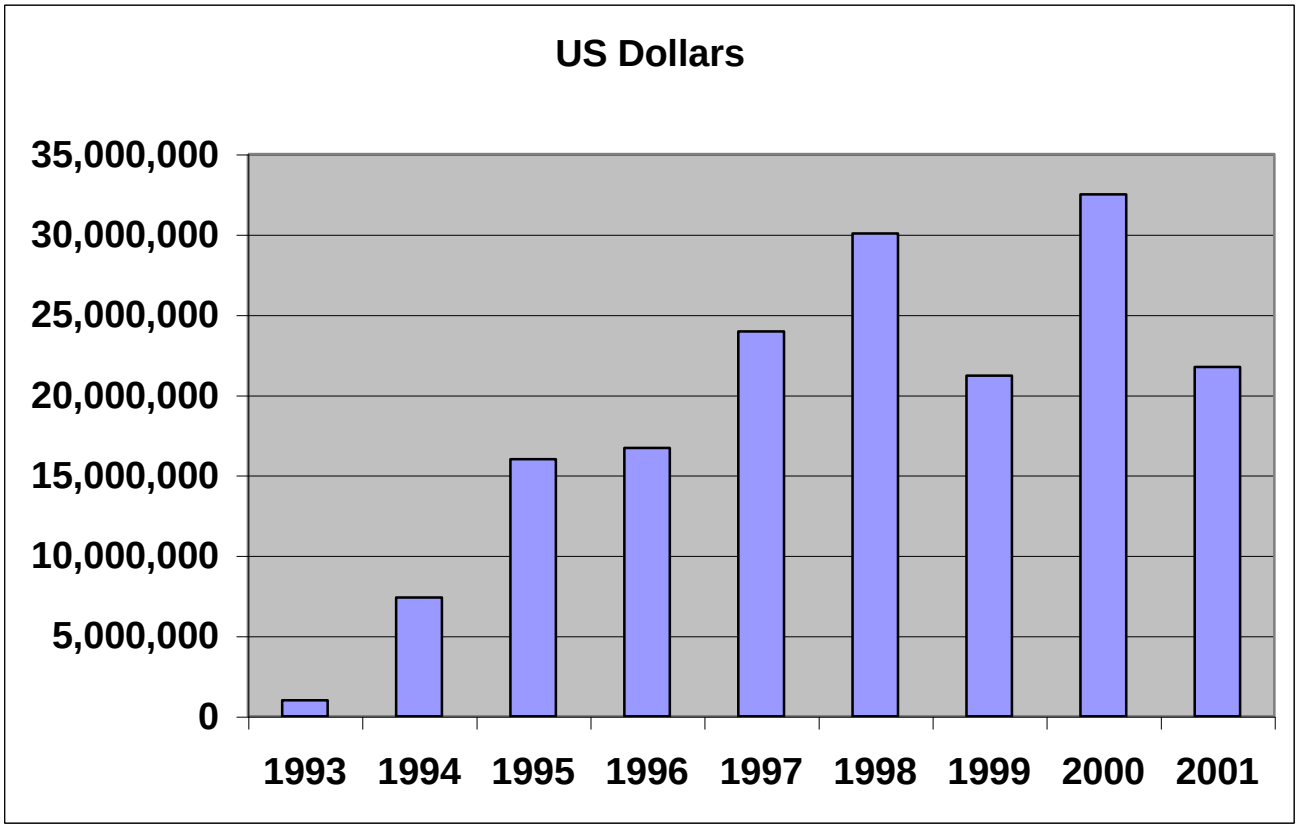
# PRODUCTION HISTORY
# (Pounds)



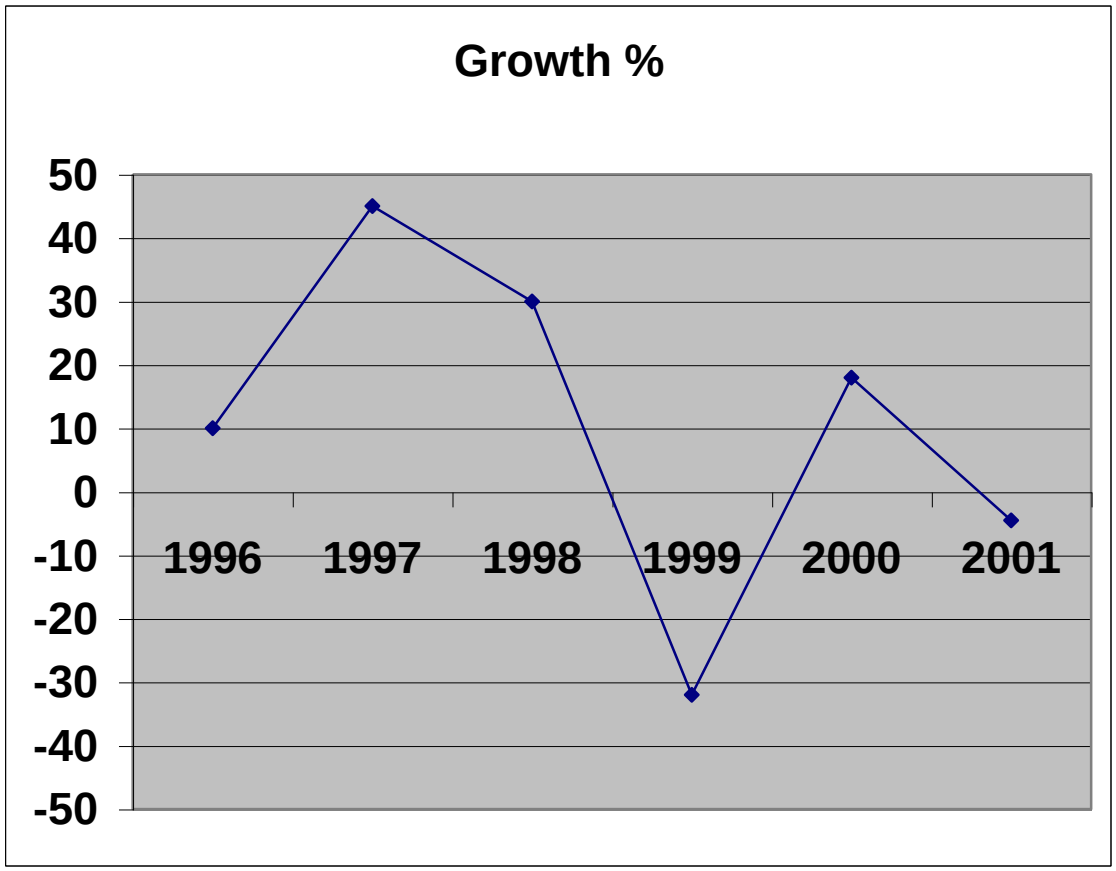
# ANNUAL YIELD
# (Pounds/ha/year)



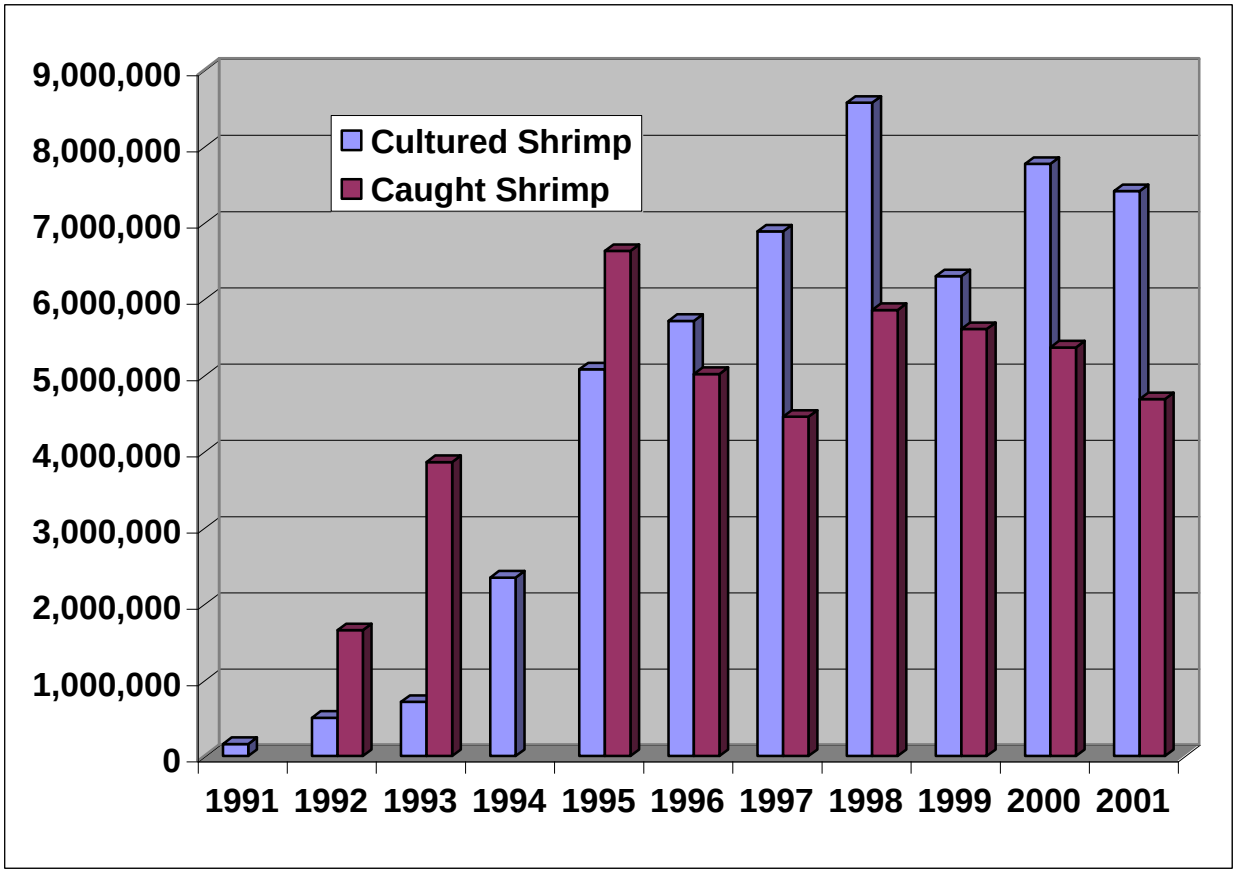
# CULTURED SHRIMP EXPORTS (Income, US Dollars)



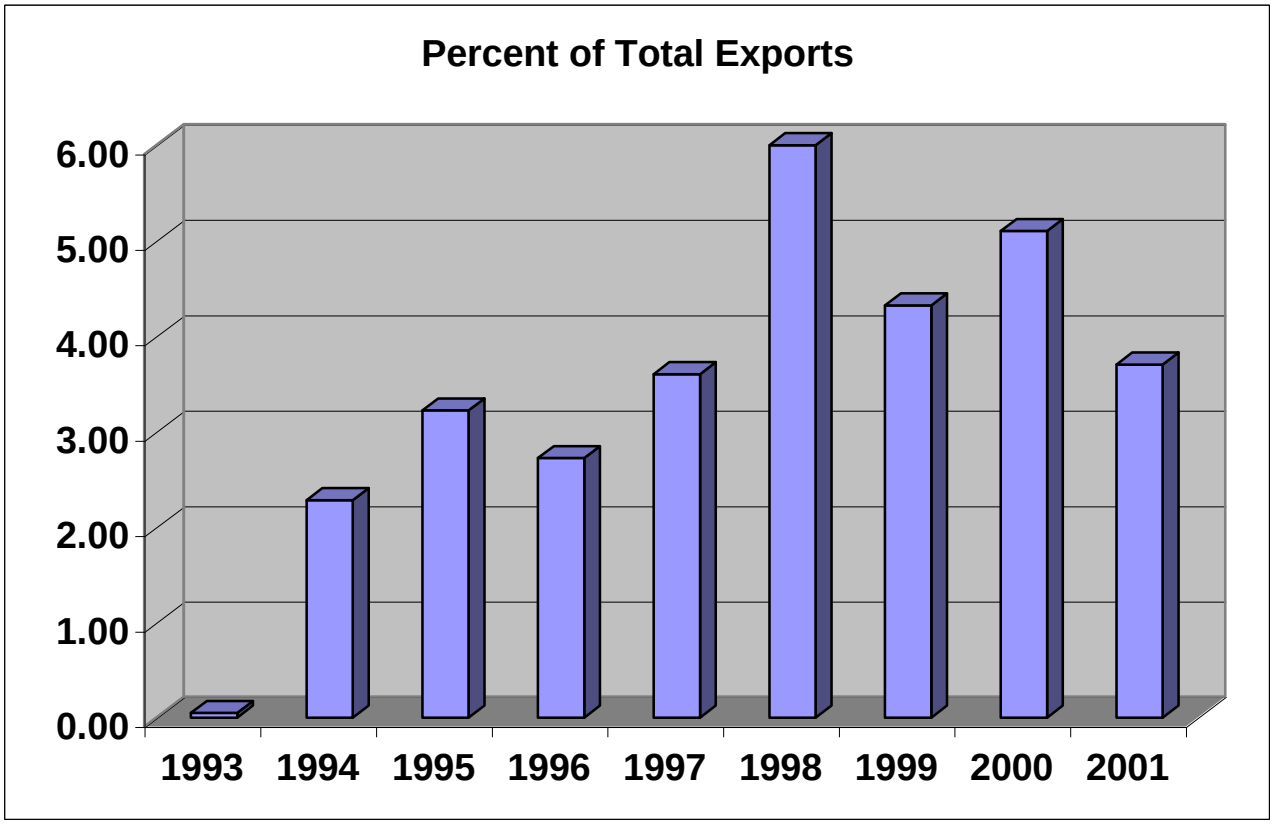
# ANNUAL GROWTH OF CULTURED SHRIMP EXPORTS



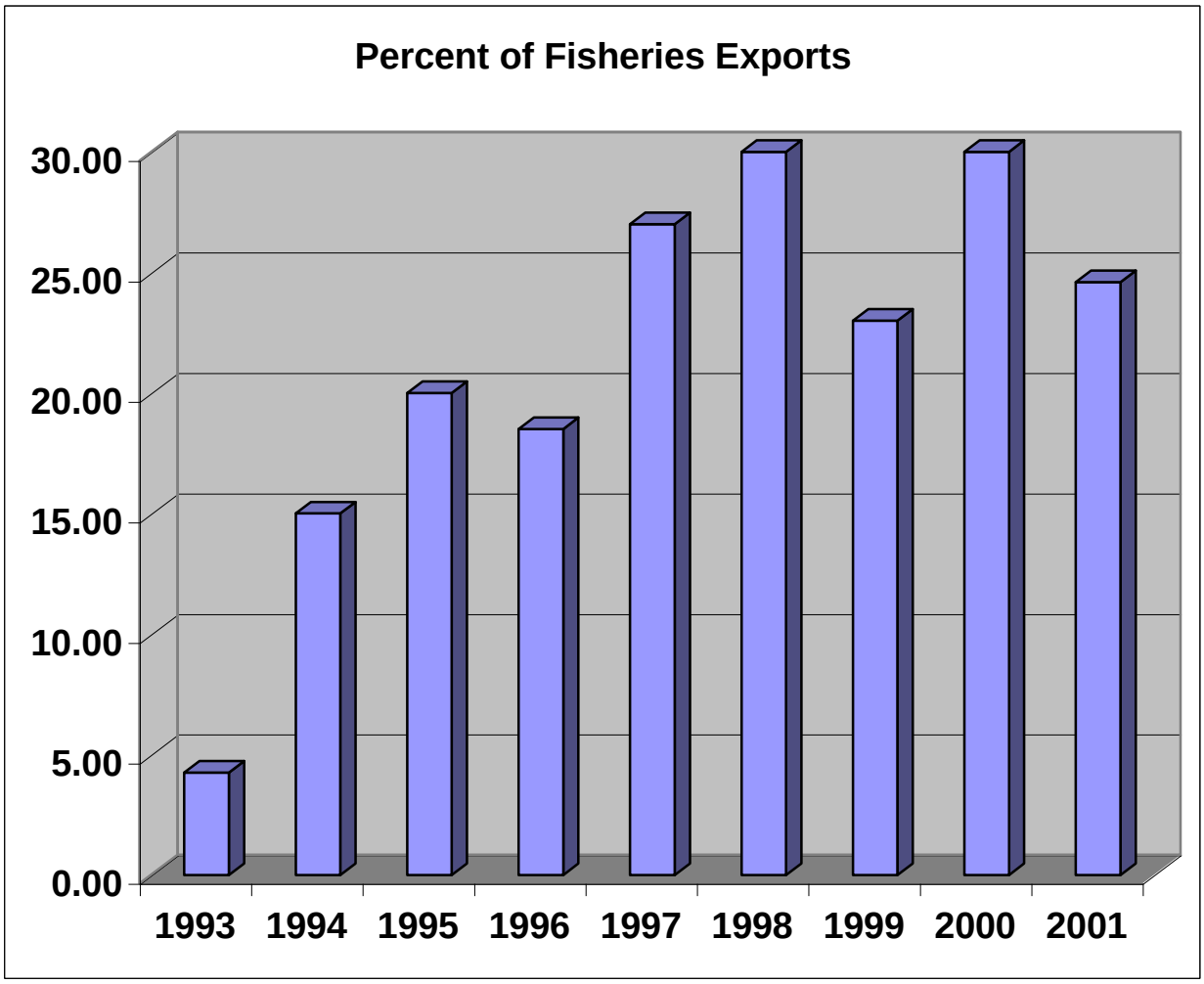
# EXPORTS
# CAUGHT AND CULTURED SHRIMP
# (Pounds)



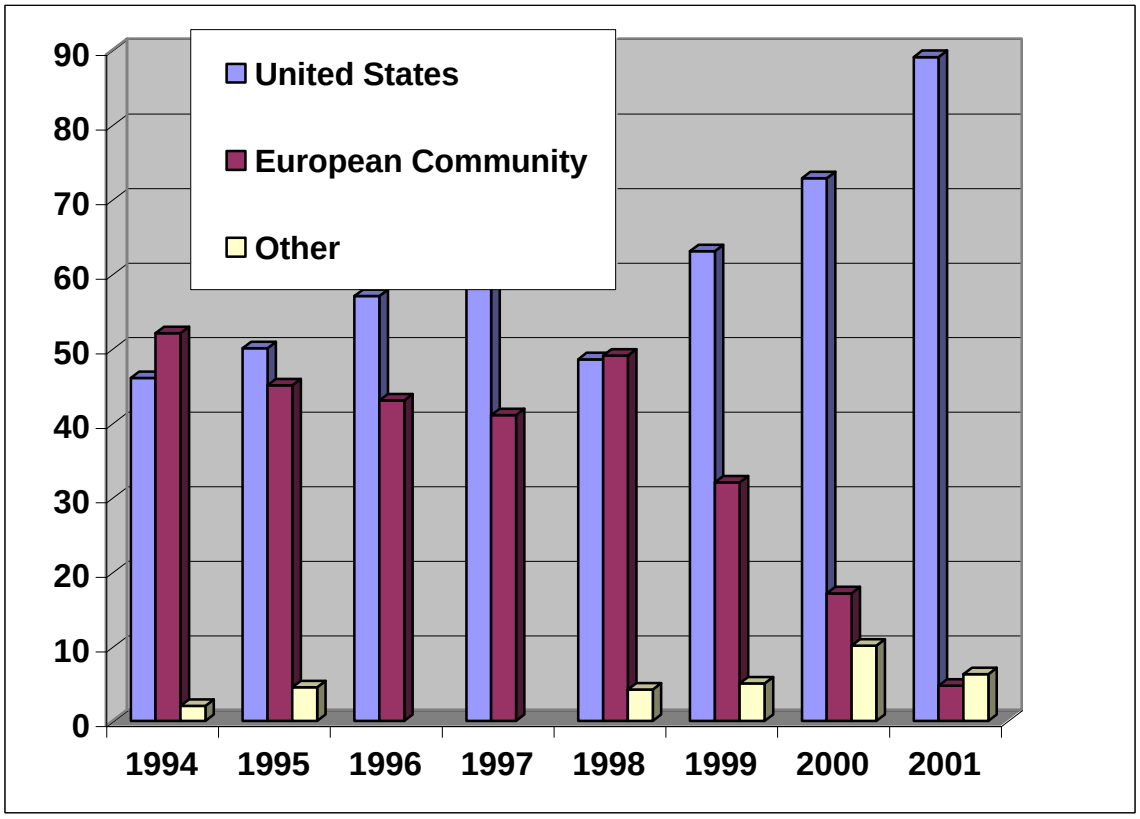
# CULTURED SHRIMP AS PERCENT OF NICARAGUAN TOTAL EXPORTS



# CULTURED SHRIMP AS PERCENT OF TOTAL FISHERIES EXPORTS



# DESTINATIONS, CULTURED SHRIMP EXPORTS (%)



# AVERAGE PRICES CULTURED SHRIMP US$/lbs./FOB