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Major Constraints Facing Development of Marine Shrimp Farming in Egypt

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ABSTRACT

Shrimp aquaculture plays a vital role as an alternative source of income for coastal fishery communities as it contribute in reducing the pressure on marine natural resources and recently is considered as an important sector for supporting rural economic development. It is expected to show growth in the marine shrimp sector in Egypt, and the success of individual operations will depend on the successful application of a variety of multidisciplinary activities. Economic viability must be linked to better marketing strategies and food safety, transparency, traceability, quality, and sustainability issues are at the forefront of Egyptian concerns and actions. Technical improvements are expected to continue to improve cost efficiency and stimulate further species diversification at a time when fisheries production is stagnant and in certain sectors in decline. Simplified legislations and licensing procedures have been called and continued as well as coherent policies for research and development is essential. We will focus in this paper on the challenges facing the shrimp mariculture development in Egypt and the requested approaches to treat these challenges and improve this industry.

Keywords: Shrimp mariculture, challenges, strategy, development, regulation.

INTRODUCTION

Introduction Shrimp culture has attracted considerable attention in recent years not only because of its value as food supply but also of its high potential as a foreign exchange earner. Several countries, realizing this fact, have given the shrimp farming industry a high priority in their fisheries programs. Also, recognized the need for the continuing development of modern techniques or procedures for the hatchery and pond culture of the marine shrimp.

Shrimp culture in Egypt dates back to the early 1980s, where a first shrimp farm were established near Alexandria (Sadek *et al*., 2002). Currently, all of shrimp hatcheries in Egypt rely on wild broodstock to produce the postlarvae needed for stocking farms. This reliance on wild broodstock can result in lost production as a result of delays in capturing broodstock or variation in the natural abundance of shrimp (Preston *et al*., 1999). Also, reliance on wild broodstock has the risk of the spread of diseases.

The shrimp farming industry still depend on wild broodstock and no trial to domesticate Peaneid species in Egypt. The sustainability of aquaculture will depend on continuous controlled reproduction achieved from generations bred and maintained in captivity, not on the permanent supply of seed or breeders from the wild. Supply from the wild will remain doubtful as long as the sustainability of the capture fisheries is not assured (Bilio, 2007). The aim of the present work was to estimate major constraints facing development of marine shrimp farming in Egypt.

MATERIALS AND METHODS

Study sites

The study sites were selected as the most important sites with history in marine shrimp farming and faced several constraints led to the failure of the shrimp production. This gives us possibility to deal with the real world of shrimp farming constraints. The advantage of working with these selected sites is the availability of facilities to study and farmers to cooperate with them. First site is the Shrimp & Fish International Company (SAFICO), Nabq Protectorate, Sharm EL-Sheikh, South Sinai, Egypt. This farm has maturation and hatchery facilities to produce marine shrimp postlarvae (PL) and experimental earthen ponds. The study at that site was carried out from January 2009 to December 2011. There was a contract between the owners of SAFICO and the author of this paper to develop marine shrimp farming and they provided the author with all facilities and technologies to overcome constraints of shrimp farming in this farm.

Second site is AL Deba Triangle, Port-Said - Damietta. At that sites there was a repeated cases of shrimp loss and crop failure and farmers does not really recognized the reason, and through the shrimp hatcheries and farm development project funded by Ministry of International Cooperation and managed by research team from Faculty of Environmental Agricultural Sciences to detect the constraints facing shrimp farming at this valuable site from marine aquaculture in Egypt.

Description of the study sites:

Shrimp & Fish International Company (SAFICO- Egypt)

The site is situated in the delta of Wadi Kid, on the Gulf of Aqaba (28^{o} 11 ó 12.6846˝ N and 34^{o} 22ó 23.8872ó E; Figure 1). Wadi Kid has a catchment area over the Sinai desert of about 1000 km^{2}, composed mainly of high mountains and steep valleys, and the delta is susceptible to flash flooding. The most recent floods occurred in January, 2010. A light to moderate North East (NE) wind blows for about 90% of the year (http://www.windfinder.com/wind/windspeed.htm). The water table is deep below the surface and the tidal range is 0.6 – 1.2 m and is of a semi- diurnal nature. The site consists of river deposits; boulders and small stones up Valley, progressing to fine sand, silt and patches of clay deposited from past flooding. Water temperatures in the Gulf of Aqaba are seasonally variable with a maximum of 27 ^{o}C and a minimum of 19 ^{o}C in August and February, respectively. Water temperature in the tidal flats is much more variable with a maximum recorded temperature of 34 ^{o}C and a minimum of 16 ^{o}C (http://www.zoover.co.uk/egypt/egypt/nabq-en-nabq-bay/weather).

AL-Deba study site

This area is defined by Damietta to the west, the Mediterranean Sea to the north, and Lake Manzala to the south (31^{o} 28ó 22.62ó N and 31^{o} 55ó 13.2486ó E; Figure 2). It comprises a triangle of low-lying and reclaimed land, which has found a natural use for aquaculture, being unsuitable for other purposes. Total area under production may be as high as 20,000 feddan (including hosha system).

Figure 1. ***Satellite map shows the SAFICO farm location including Growout ponds, hatchery, power generators, green houses and staff accommodation.***

Figure 2.Satellite map shows the Deba Triangle location including Growout ponds.

Methods carried out to perform stage one of the study

This study was carried out with the purpose of collecting knowledge concerning constraints facing shrimp farming in Egypt. This study includes extensive survey and filed study at two sites with history of shrimp production and suffered from failure of marine shrimp farming.

Survey of the shrimp production constraints at both sites:

The identified major constraints in SAFICO and AL – Deba Triangle farming system were: Bad feed quality; high feed cost; low growth and low survival. In addition to pond construction, Pond soils, farm layout and management practices problems of each site were identified.

RESULTS

Survey of constraints facing shrimp culture in Egypt and pilot experiments to practical diagnosis these constraints.

The results of this stage were organized in two sections. The first one is concerned with the results of the survey of the sites with history of shrimp farming. The second section is concerned with the results of the pilot experiments at the two selected sites of potential history of shrimp farming and faced several constraints in shrimp culture. The second section was started after knowing the key constraints in section one. The results organized as follow:

Survey of the shrimp farming sites in Egypt. The constraints facing development shrimp mariculture in SAFICO and AL-Deba Triangle Zone.

During the last three decades, there has been increasing investment in shrimp farming in Egypt and there are clear indicators for further investments, but still the production results are not commercially positive. Two crustacean species are famous and routinely used by local farmers in the production namely; ***Penaeus semisulcatus*** and ***Marsupenaeus japonicas.*** Today Egypt has two marine private hatcheries operate with a low production capacity and are not working regularly, but works according to the demand of the farmers, as in some years there is no demand for the shrimp postlarvae and in some other years the demand in average cannot exceed thousands of shrimp Postlarvae (AL-Deba and Shata farming Zones).

Few farms sometimes culture shrimp and these farms are not specialized in shrimp production, but are stocking shrimp after the nursery period of marine fishes collected from the wild or obtained from the two working marine hatcheries (Haraz and AL- Wafa marine hatcheries). The management and production of these shrimp farms during 90-150 days of grow-out are ranging for stocking densities (5 to 20 post larvae (PL)/m^2), survival rates (< 5 to 82 %); average animal weight at final harvest (<10 to 32 gm) and shrimp yields average 26 to 864 kg/ha per year, converting this production value into our local calculation kg/feddan, considering 1 ha= 2.38 feddan, then the production kg/feddan/year (864/2.38) = 363.02 kg/feddan/year. There is only farm specialized in shrimp production and played important roles in developing shrimp farming in Egypt namely; SAFICO farm which worked and stopped several times for the reasons of the lake of seed technology, feed technology, disease problems, logistic problem of environmental agencies and high production costs. Based on the results of the survey, the Shrimp culture can develop rapidly in the coming decade if:

1. We could mitigate the technical and institutional constrains mainly (quality of seed production and their limited seasonality from April to August;
2. We solve competition and restrictions on coastal land;
3. Develop feed industry provides specialized feeds;
4. We solve shortage of technical manpower;

5. Lack of information on the environmental impact and impact of disease stress;
6. We evaluate the production parameters of the different shrimp species in the coasts of both the Red Sea and the Mediterranean;
7. We decrease the cost of PL and juvenile around the year;
8. We enhance the availability of skilled capacity staff;
9. We achieve progress in applied scientific research and transfer the knowledge to the farmers by extension demonstration;
10. We enhance high quality formulated feed and understanding of shrimp pathogens and microbial ecology, by the use of environmentally friendly methods using selective breeding programs.

DISCUSSION

Preliminary study on detection of factors responsible for shrimp production failure in Egypt.

Survey of constraints facing development of marine shrimp farming in Egypt: Case study of two potential sites for shrimp farming in Egypt.

Most shrimp aquaculture is undertaken in the north of Nile delta near the Mediterranean Sea (AL-Deba and Shatta Zone) as well as along the Red Sea coast (Gluf of Aqaba, Nabq area) (Table 1).

This study indicates that SAFICO and AL-Deba and Shatta are main areas of Penaeid production and farming regions in Egypt (Table 1). Seed stock is considered a problem in Egypt because it is responsible on viral disease transmission, failure of the shrimp production as proofed from the present study. The shrimp farms depends mainly on farming shrimp postlarvae collected from the wild and postlarvae comes from hatchery depends on spawning of gravid females collected from the wild. They grew out the PL8-20 in the grow-out ponds. Air and water temperature are presented in (Figure 3). The farming operation located in the Gulf of Aqaba area were average air temperature during the year is 4 degrees higher than in the Mediterranean Sea. This helps to extend growout season in the Red sea region compared to Mediterranean Sea.

Both extensive and semi-intensive shrimp culture systems were the default farming practice used in the study sites. Extensive shrimp aquaculture is only used in AL-Deba and Shatta sites where salinity was 30-35 ppt. The most common system in SAFICO was the semi-intensive. ***P. semisulcatus*** is the main shrimp species used followed by ***P. japonicas.*** Shrimp postlarvae normally collected from the Mediterranean coast near the Damietta branch of the Nile Delta. ***P. kerathurus, M. monoceros*** **and** ***M. stebbingi*** were the most adapted species. Growth rates in SAFICO do not vary much from those observed in stocks in the Mediterranean

Table 1. ***Some characteristics and status of marine shrimp farms studied in this study in Egypt.***

Farming Regions	Grow-out		
	Number of ponds	pond size (ha)	Average Total area (ha)
SAFICO (Shrimp and Fish International Company, Nabq, South Sinai)	19 were constructed and working	0.3	30
AL-Deba and Shatta shrimp farming , Portsaid and Damietta	-	1	50 ponds that practiced shrimp farming during the last decade
Total	-	0.3-1	80-100

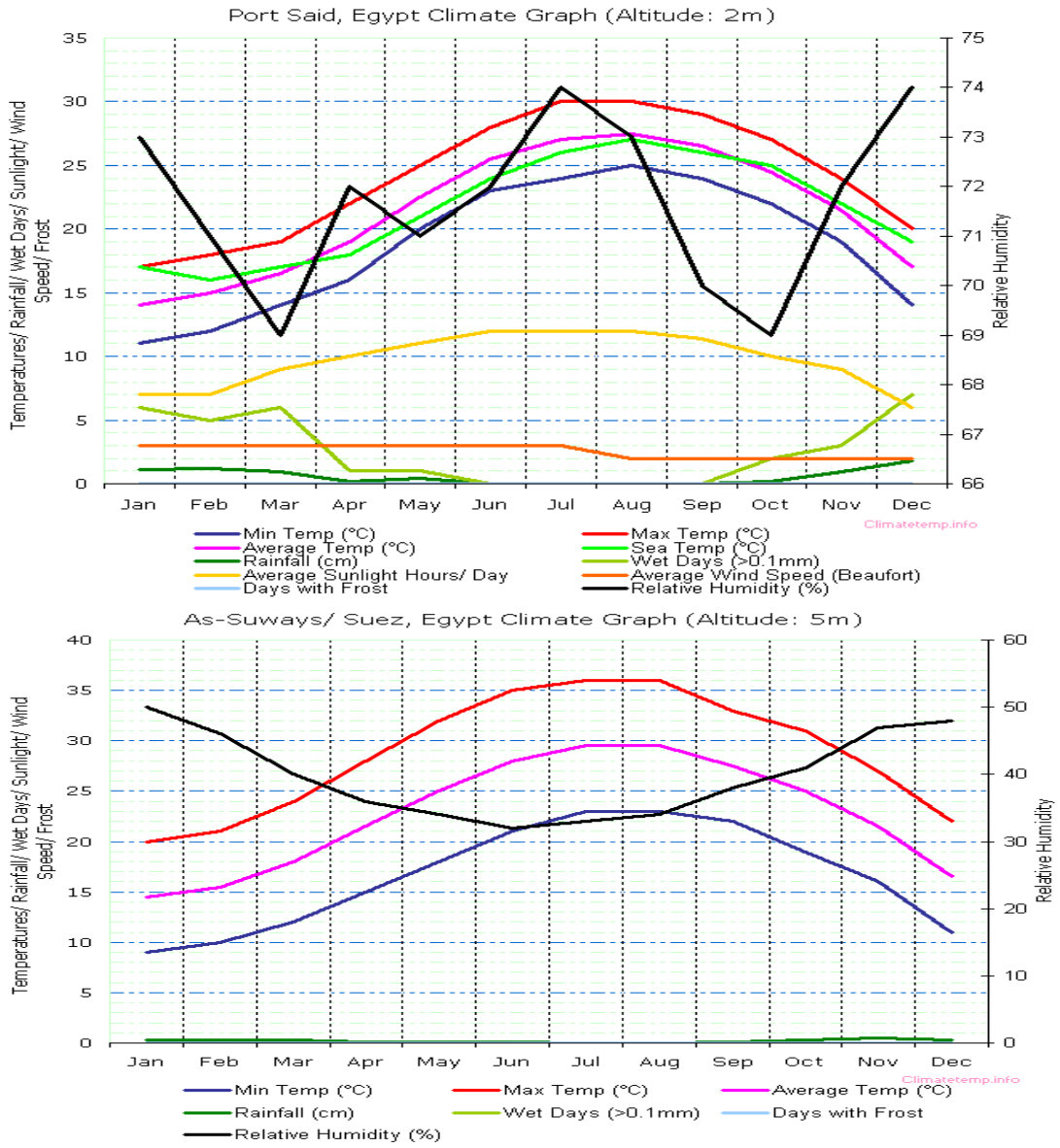

Figure 3. Average weather value of two different points (Portsaid and Suez) in Egypt.

Sea, 5 and 3 mm/month respectively. The grow-out phase in earthen ponds allows observation of the adaptation of the animal to the local environment (Bishara, 1976; Ishak *et al*. 1980; Abdel- Razek 1991).

In the most positive results during periods of shrimp farming in Egypt, the average weekly weight gain is 1.91g for ponds enriched with fertilizer and commercial feed, while 1.44 g for ponds enriched only with fertilizer. Annual yield varied from 360 to 864 kg/ha for *P.*

japonicus using fertilizer and commercial feed. It takes approximately 4 months to produce 33 shrimp per kg and 7 months to produce 12 to 15 shrimp per kg (Sadek, 1989a, b; Sadek, 1993). Pond stocking densities vary between 3 and 15 shrimp/m^2 and harvest size is between 20 and 41 g. Farmers average one crop per year, either in the Mediterranean or Red Sea Coasts, and production per hectare ranges from 600 to 2,250 kg of shrimp per year.

Feed problem represent a major constraint in the production of marine shrimp in commercial farming in Egypt. Several trials were done on pilot scale to produce marine feeds, but due to economic problems of low farming technology, these trials did not continue and farmers depend mainly on fresh trash fish in feeding their shrimp postlarvae. SAFICO manufacture their own feed on the farm. The main composition of the shrimp feed is fishmeal (either local or imported), local shrimp meal, concentrates, soyameal, corn meal, local fish and vegetable oil, and perimex (soya lecithin, cholesterol, vitamin, mineral and binder). The percentage of crude protein can fluctuate from 38-45% for ***P.semisulcatus*** and from 42-50% for ***P.japonicus*** based on the age of the animal.

The surveyed constraints can be summarized in the following items:

Shrimp Seeds

Production of gravid females in hatcheries is seasonal (from April to August) so prices also fluctuate according to the demand of shrimp farms along the Mediterranean coast where temperature decline in winter and rearing stops in December at the latest. Current prices for ***P. semisulcatus*** or ***P. japonicus*** are 80 L.E for one thousand PL15. The future development of shrimp culture in Egypt depends on developing a better hatchery system that can close the life cycle (Domestication program) and produce PL earlier in the year, producing high quality PLs and pathogen free as well as reducing the overall cost PL.

Competition and Restrictions on Coastal Land

The jurisdiction of the land along the Egyptian coasts is increasingly divided among several Ministries. The Tourism Development Authority (TDA) has seized Sea Coasts for tourism projects and is planning to seize other land for future projects. However, such lands are still important candidates for petroleum production, industry and urbanism as well as for conservation of protected areas. The Egyptian Environmental Affairs Agency (EEAA) has proclaimed seven areas for protection in the Mediterranean and Red Sea (Zaranik lagoon and El-Amid in the Mediterranean Sea; Nabq, in the Gulf of Aqaba).

Availability of Specialized Feeds

The existing feed manufacturing infrastructure has the overall capacity to support the growing aquaculture industry to a certain extent. However, marine shrimp culture normally requires high quality feed, which in turn requires some ingredients that are lacking in the local market, especially high quality fishmeal. It is extremely difficult to obtain supplies of good quality raw material in local markets, especially attractants, binders and cholesterol. It is also clear that all the available feed manufacturing plants in Egypt are not adapted to produce shrimp feed. Their main focus is not even fish feed, but rather feed for chicken and beef. Specialized larval feed such as enriched live food and microencapsulated larval feeds may also be required. However an economic analysis is required in order to assess the feasibility of mariculture projects using such expensive feeds.

CONCLUSION

Both ***P. semisulcatus*** and ***P. japonicus*** are farmed. These species are indigenous and available in the Egyptian environment either from the Mediterranean or the Red Sea. There

appear to be several possible reasons that these indigenous species have been cultivated to the exclusion of imported species, they perform well in the single crop/year production systems common in Egypt, they do best in low stocking density systems also common in Egypt, they are both acclimatized to high water salinity in the Red Sea, and both appear to perform well with low quality shrimp feed. It is not clear which of the two species, in the two locations, actually perform better. Monitoring performance over time should make the answer clearer. It is quite likely that one of the species will outperform the other, but that is not yet clear. Even if one of the species performs better in one of the sites, which does not mean that cultivation of the other would not also be profitable. At any rate, to date there have not been disease problems in either of the grow out areas with either of the species. It is recommended that Egyptian aquaculture could benefit from experiments conducted in other countries. However, it is essential that these "lessons" be adapted to physical, technical and social conditions in Egypt before being adopted and put into practice. Also Egypt must learn from its own mistakes. The failures and problems that have appeared in different Egyptian companies should also help to shape future activities.

Several constraints to the shrimp culture could be avoided by the following

Decrease the cost of seed by decreasing the operating costs and increasing the intensity of production.

Evaluate production parameters for both *P. semisulcatus* and *P. japonicus* in the two different ecosystems, e.g. the Red Sea and the Mediterranean Sea coasts.

Enhance the availability of skilled staff and increase the capacity of unskilled staff.

Support investments in the production of shrimp feed and ensure that necessary quality standards are met.

Enhance a sustainable marine shrimp aquaculture research based on both a short and long term vision.

Encourage the private sector to establish local dealer companies to import feed and equipment needed for the industry (aeration systems, feeders, etc).

Establish a pilot shrimp farm in the area of the Red Sea to study the impact of pollution on the ecosystem as well as to identify and analyze the costs of mitigation methods.

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اهم التحديات التي تواجه تطوير استزراع الجمبرى البحري فى مصر

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على الرغم من أن الاستزراع البحرى للجمبرى يلعب دورا حيويا كمصدر بديل للدخل بالنسبة للمجتمعات الساحلية حيث انه يساهم في تقليل الضغط على المصادر الطبيعية للأسماك والقشريات و حديثا يعتبر قطاع هام في تنمية اقتصاديات المجتمع الريفي المصري. فانه من المتوقع بالنسبة لمصر ان تظهر تقدم في قطاع الإنتاج البحري للجمبرى وان نجاح العمليات (المشاريع) الفردية سوف يعتمد على التطبيق الناجح لمجموعة من القطاعات و الأنشطة المتكاملة. ويجب أن ترتبط الأهمية الاقتصادية بإستراتيجية تسويق جيدة ، امن غذائي ، شفافية ، متابعة ، جودة ، واستمرارية. و كل ذلك يجب ان يكون في مقدمة الاهتمامات والإجراءات المصرية. كما يتوقع حدوث تطور تقنى و ذلك لتحسين كفاءة التكلفة و الحث على إدخال أنواع جديدة في الوقت الذي قد ثبت وانخفض فيه إنتاج المصايد البحرية. كل ذلك يتطلب إجراء تسهيلات ضرورية في التشريعات والتراخيص اللازمة وكذلك وضع سياسات خاصة بالبحث والتطوير. وسوف نركز في هذا البحث على التحديات التي تواجه تطوير استزراع الجمبرى البحري في مصر والأساليب اللازمة لمعالجة هذه التحديات.