Desert Aquaculture In Israel

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Introduction

There are two main desert belts on the globe both are in the subtropical region. More than 30% of the world's land is desert and our region, the Mediterranean and the Middle East, is more than 50% desert. Investigations during the past three decades have revealed that large aquifers of fresh and brackish water sometimes geothermal, exist under most deserts in the world. The well known phenomenon of artesian wells cause water to emerge up to the surface, forming an oasis or a lake. Often, deep wells are dug, allowing large communities to use these water for drinking as well as agriculture.

Desert Aquaculture in Israel

In Israel, over the last century, advanced agricultural techniques have been developed especially in areas of arid region farming. Today the country produces and exports large quantities of premium quality agricultural products. Our desert region has forced us to develop an advanced irrigation infrastructure in order to take advantage of all the available water resources.

By introducing aquaculture as the first link in the "chain of users", we improve the efficiency of water resources. Since fish do not consume water, but rather use it as a medium of growth, no competition exists in the system. The fish production is an economical added value to water utilization before the water is used for irrigation.

Two types of fish farming can generally be identified in aquaculture: warm water (Tilapia, catfish, etc.) and cold water species (Trout, Salmon, etc.)

The problem arises when wanting to raise one species in an environment to which it is not indigenous. This situation usually results in slow growth rates and reduction of the fish's immunity to diseases. For example, Tilapia suffers from low growth rates and poor health when temperatures fall below 20°C. Unfortunately, most developed areas using intensive warm water aquaculture are situated in the temperate zones. Fish farming in Israel faces the problems of low temperature during 6 months of the year. In order to keep fish alive, overwintering storage systems have been developed. These systems demand relatively high investments in order to maintain optimal conditions for fish production. For instance, we build plastic covered structures over fish ponds to keep optimum water temperature during the production. Several forms of tanks, and methods of covering have been tried recently: A metal frame greenhouse (with special treatment of the metal piping to prevent corrosion), the "Aquabubble" (a frame-less inflated plastic cover made of net-reinforced PVC), and other shapes such as the "Igloo" or "Tent" are set up similarly

The cover material selectively blocks infrared radiation escaping from the pond, thus reducing heat loss, while allowing the sun's rays to pass through and warm the pond during the day.

In addition we take advantage of the natural conditions in the desert: clear sunny days all year round, and many sources of geothermal hot brackish water. We prevent seepage by lining the ponds with plastic sheeting. Finally, integration in nearby "green agriculture" as water end users is most important.

Production strategies have been revolutionized, from the first, simple "flow-through" system to the advanced biofiltration methods used today. Originally, water was continually passed through the fish tanks flushing out suspended solids and harmful nitrogenous wastes. A relatively high volume of

water was needed to maintain the conditions in the pond. When the end user demand drops (during the winter months, when irrigation levels are low) the disadvantages of this method becomes severe. To overcome this problem, water recirculation systems were developed. We introduced biofiltration and compartments for solid-waste removal to keep optimal water qualities. Water exchange rates for fresh or brackish water can vary from 5% to 15% daily. We employ mechanical aeration by paddle-wheel aerators or aspirators, to maintain optimal oxygen concentration for the dense fish population. Biological water treatment occurs in a culture tank with aerobic nitrification of suspended particles and clusters of bacteria. This system is also supported by a trickle-filtering treatment through polystyrene particles or other inert substrates. During this treatment, thin films of nitrifying bacteria form on the substrate surface, thus oxidizing ammonia to nitrate.

These fish production systems, which produce an annual yield of over 20 kilos per cubic meter, demand superior management and skilled personnel. The yields and profits of four model farms in the Negev-Arava region have shown promise. The farmers, who began their model farms with annual productions of 30-50 tons decided to expand in order to reach the 100-150 tons annually. Intensive nursing ponds raise the 80-120 gr. Tilapia fingerlings and then they are transferred to the rearing ponds, so production is continuous and the supply to the markets is stable and reliable.

The farmers continue to improve the biofiltration units. Fluidized beds and trickling filters undergo additional refinements to maintain good water quality. Experiments and pilot projects with hydroponic biofiltration in the Desert Aquaculture Research Station, indicate that combining these new filters with the existing biofilters can achieve improved and sustainable water quality. This method opens the door to "dual cropping" whereby herbs and vegetables could become an additional income as by-product.

conclusion

The success of any project is always a combination of human and technological factors. Modern desert aquaculture must have a reliable supply of high quality, clean seedstock from a superior genetic origin. Know how and management training is a prerequisite for hatchery operation producing a variety of high value fish and shrimp. In today's economy, aquaculturists should maintain optimal efficiency in their facilities and reduce production costs in order to stay profitable. The introduction of more fish species to desert aquaculture like the hybrid Striped Bass (*Morone saxatilis* X *Morone chrysopsis*), Australian Sea Bass (*Lates calcarifer*), Red Drum (*Sciaenops ocelatus*) and the Australian Red Claw (*Cherax quadricarinatus*) will increase profitability. A professional approach to aquaculture means staying abreast of research and development in the field, and exposing oneself to new technologies.

Market studies show that the demand for high quality fresh fish is now expanding in Israel and in many developed markets. Aquaculture is expected to become the main source for quality fish products in the future. Marketing strategies should be studied further to ensure that this increased demand is met. Therefore, advanced technology and modern management are the key to success.