

The status of aquaculture in Lebanon

NADA LEBBOS AND I. PATRICK SAOUD¹

Lebanon is a mountainous country on the eastern shores of the Mediterranean Sea, north of Israel and west of Syria. It is a country of four distinct seasons with considerable precipitation compared to its geographical neighbors. Because of its topography, rain carrying clouds moving eastward from the Mediterranean dump their water on the western flanks and peaks of the mountains, thus creating an arid or semi-arid region to the east. Lebanon has 217 km of coastline and an abundance of natural springs, small rivers and artesian water. This abundance of water and snow during the winter ensures a constant replenishment of underground water reservoirs and the continuous flow of major rivers. Most rivers, however, are seasonal and only flow during the wet winters and in the spring, when snows are melting. Aquaculture in Lebanon is not new. For hundreds of years people have stocked tiny fish into small reservoirs to control mosquitoes in summer. However, these fish were not fed, nor were they consumed by people.

Lebanon's population is approximately four million. Statistics showing fish consumption per capita are not available but it is common knowledge that fish is consumed mainly by coastal inhabitants, which make up more than two-thirds of the population. More than 95 percent of the fish consumed is marine. During the long civil war that ended in 1989, investment in Lebanon was scarce. In recent years, an increase in economic activity and development of an infrastructure coupled with an increase in tourism has raised demand for seafood products. Capture fisheries in Lebanon doubled between 1996 and 2002 (www.agriculture.gov.lb July, 2005). Fisheries in 2003 amounted to about 7,000 t of marine fish, mainly sardines and anchovies.² Meanwhile, Lebanon imported 30,500 t of fish at a cost of US\$13,470,000 (www.customs.gov.lb July, 2005). Because of low wild fishery yields and an abundance of pristine cold rivers and springs, small trout farms have sprouted throughout the country. Moreover, returning expatriates have introduced new ideas from around the world, including new approaches to aquaculture. There are now farms or pilot projects involved in raising rainbow trout, various species of carp, catfish, tilapia and shrimp, while the culture of tuna and seabass in cages is being considered.

Most of the freshwater aquaculture in Lebanon is located in the north of the country, mainly on the Assi River with 70 percent of all farms and in the Akkar region, with about 15 percent. The rest are interspersed between the cen-



tral mountains, Beirut and the Bekaa, with very little in the south. There is only one saltwater aquaculture facility in Lebanon. It is a penaeid shrimp farm in the northern town of Abboudiyeh.

Aquaculture Species

More than 90 percent of aquaculture production in Lebanon is rainbow trout, *Onchorhynchus mykiss*. Some *Salmo trutta fario* is also being tried. The national production of trout was estimated by the ministry of agriculture to be approximately 600 t in 2002, but farmers estimate a production of 1,000 t. The ministry of agriculture purchases eggs from Denmark, incubates them at the national trout hatchery in Anjar (Figure 1), and distributes the fry to farmers free of charge. Some of the larger farms also purchase eggs and incubate them. Various farms now have

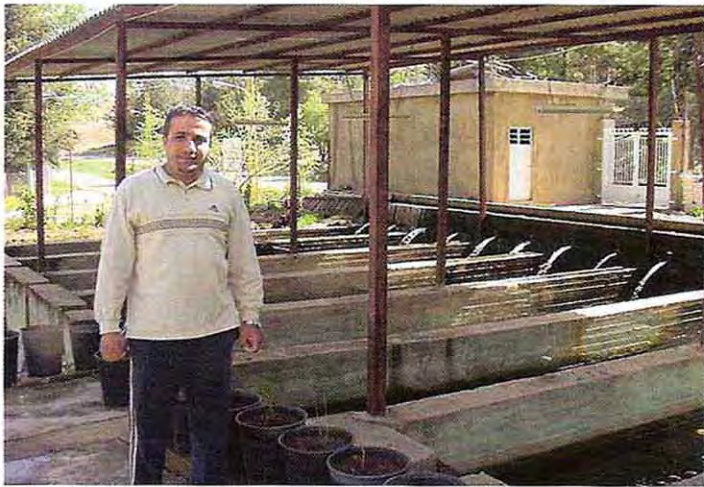


Fig. 1. National trout hatchery at Anjar with manager Ibrahim Al Hawi.



Fig. 2. A typical trout farm in the Hermel region.

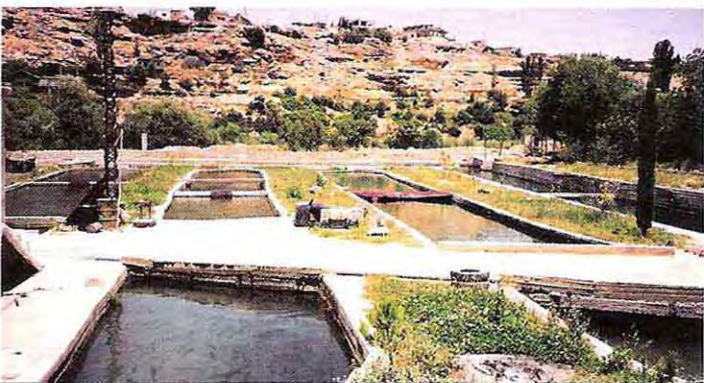


Fig. 3. Trout raceways.



Fig. 4. A typical trout restaurant in Lebanon.

broodstock operations and intend to produce eggs in 2004.

Farmers grow the fish to market size in concrete flow-through raceways or ponds (Figures 2 and 3). Water is aerated by flowing down small terraces. Medium size fish (about 400-500 g) are sold live to restaurants (Figure 4) that have their own concrete holding tanks. Larger fish are sold mainly to other Arab countries or to supermarkets. Value added products are still lacking on the Lebanese market. Furthermore, the Lebanese are accustomed to marine fish and do not readily purchase trout for home cooking.

The second most cultured fish in Lebanon today is tilapia. There are three farms that grow tilapia commercially. The first is in the north of the country in Akkar (Figure 5). The farm stocks various species in earthen ponds. The owner bought live fish in Syria in the late 1990s and stocked them in a pond. He now sells whatever he harvests back to Syria. Some pond-side sales are made in Lebanon but no records are available regarding harvest weight. The second farm is in the region of Byblos (Figure 6). The owner was a pupil of James Rakocy in the Virgin Islands and is now developing a hydroponics system to go with his concrete round tanks. The farm is still in the trial stage and harvest numbers are not yet available. The third farm is in Hadath, south of Beirut (Figure 7). It uses an artesian well that is now unsuitable for traditional agriculture because of saltwater intrusion. The growout system consists of an oval concrete raceway that recirculates water through a settling basin, a rotating biological contactor and an airlift. The whole system is located in a greenhouse structure. Finally, several of the trout farmers are trying to diversify into tilapia but water temperatures are a challenge. All tilapia farmers offer their fish a 36 percent crude protein, six percent crude fat feed manufactured by Arasco Feed Mill, Saudi Arabia.

Common carp, bighead carp, silver carp, grass carp and leather carp are being grown on some of the trout farms. Sales are low and mainly to Syria. The tilapia farm in Akkar raises tilapia and all the aforementioned carp species in communal ponds (Figure 5). The fish are offered a diet of ground corn. The farm also raises catfish, *Clarias* sp. in some ponds. Carp and catfish are spawned using pituitary extract that the farmer removes from some of his fish. Additional small carp ponds are dug next to rivers. Farmers tend to dig narrow and long raceway shaped ponds on the flank of rivers and divert water into them at one end and back to the river at the other (Figure 8).

The only marine species being reared in Lebanon today is the shrimp *Litopenaeus vannamei*. Shrimp are stocked as postlarvae into 0.2 ha earthen ponds filled with full strength seawater (38 ppt) and equipped with paddlewheel aerators (Figure 9). Water is exchanged as needed. The farm imported postlarvae from Florida in 2003 but survival was less than 20 percent. In 2004, postlarvae were imported from Malaysia. The farm manager reported that 20 g shrimp are sold live on the Lebanese market for US\$12 per kg.

Aquaculture Potential

The abundance of fresh and salt water in Lebanon makes it a prime site for aquaculture production as well as re-

search. There are more than 20 universities in Lebanon and an abundance of expertise, but a lack of funds. However, the situation is changing. Lebanon's location on the Mediterranean, its trilingual population, its semi-arid weather and its strategic position at the intersection of three continents coupled with academic know-how make it attractive for investors and research money. Lebanon's freshwater resources are used mainly for irrigation. This water can have a dual use, where it can be pumped into reservoirs for aquaculture and then used to irrigate fields. Such conservation methods could be very beneficial to the arid regions of the Near East, Middle East and North Africa. Moreover, the species of marine fishes consumed in the Middle East are different from those consumed in the rest of the world and aquaculture protocols for those species need to be developed. Lebanese universities could train Arabic speaking experts to transfer the technologies developed to the rest of the region.

However, some surmountable difficulties do exist. On a geographic level, Lebanon does not have any estuaries or major spawning grounds with high productivity and low salinity. Therefore, marine aquaculture is limited to salinities in excess of 38 ppt. Moreover, seawater temperatures in Lebanon vary between 15° C in January and 28° C in August. Such temperature shifts present challenges that are not encountered in the warmer areas of the Southern Mediterranean nor in the Red Sea and Arabian Gulf.

Another problem for aquaculture in Lebanon is regulatory. There are presently no governmental policies, environmental or otherwise, that cover aquaculture. The industry, thus, falls under the Ministry of Water Resources, Ministry of Agriculture, Ministry of Industry and Ministry of Environment. Because none of these agencies know what to do with aquaculture, there are no controls on water usage, effluent quality and disposal, importation of exotic species, location of farms, usage of chemicals or introduction of diseases. This is a recipe for disaster. The Ministry of Environment has a protocol for an environmental impact assessment for aquaculture projects but it is not being implemented mainly because nobody is sure if aquaculture falls within their jurisdiction. However, interest and awareness are rising and various institutions are working to draft policies that will be reviewed by the government agencies concerned.

Aquaculture Research Centers

Aquaculture research in Lebanon is performed mainly at three major universities and two government centers managed by the Ministry of Agriculture. The major aquaculture research program is at the American University of Beirut. Research there is presently focusing on rabbitfish (*Siganus* sp.) and sea bream (*Diplodus sargus*). Other projects include work on grouper (*Epinephelus* sp.) and the health benefits of fish consumption as well as development of dual water usage technology in semi-arid regions. At other institutions aquaculture research projects involve trout growout and technology transfer at the Anjar State Hatchery, trout and siganid research at the Lebanese University and some marine aquaculture research at Balamand University and at the government's Institute of Fishing and Oceanography



Fig. 5. Tilapia ponds.



Fig. 6. Tilapia and aquaponics farm in the region of Byblos.



Fig. 7. Tilapia Recirculating system in Hadath near Beirut with Ramon Khoury, the designer of the farm.



Fig. 8. Carp pond dug parallel to the river. Water is diverted into the pond on one side and released from the other back into the river.

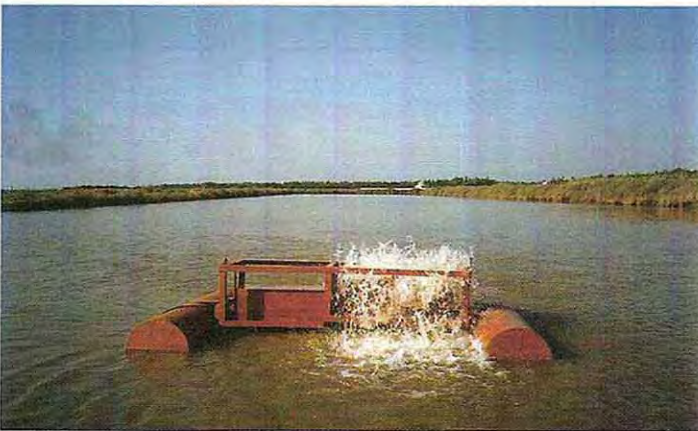


Fig. 9. Shrimp farm in Abboudieh.

EDITORIAL COMMENT

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ture and debate is healthy. What better place to have those debates than in the *World Aquaculture* magazine? When a letter to the editor involving an article in the magazine is received, the author of the subject article will be contacted and provide the opportunity to respond. I did offer the authors of the December article the opportunity to respond to the letter to the editor that appears in this issue, but have not as yet received such a response. If one comes, it will be published.

So what is our editorial policy? In a nutshell, it is to publish as wide a variety of information on aquaculture as possible. Some of the information is rather technical, but much is not. Some represents rigorous science, much does not. Most articles focus directly on aquaculture, but some do not. In a coming issue we will have a very interesting article on bacterial issues associated with refrigeration of fish using different types of packaging. The topic relates to any fish product, aquacultured or not. But it does certainly

in the region of Batroun. There is little cooperation among institutions, but that is being remedied by the researchers themselves, who are now attempting to develop a joint aquaculture initiative for Lebanon.

Notes

¹Department of Biology, American University of Beirut, Bliss St., Beirut, Lebanon. (Imad Patrick Saoud is the corresponding author.)

²Mr. Elie Choueiry, Ministry of Agriculture, Beirut, Lebanon.

³The following are a list of contacts for people interested in aquaculture research or investment in Lebanon or the Eastern Mediterranean:

Imad Patrick Saoud, PhD

Department of Biology
American University of Beirut

Bliss Street, Beirut, Lebanon

Tel:(961) 1 35 00 00, X-3913

E-mail :is08@aub.edu.lb

<http://staff.aub.edu.lb/~is08/>

Ibrahim Al Hawi, Agriculture Engineer

Ministry of Agriculture

Tel:(961) 3 81 68 97

e-mail: hawi_leb@hotmail.com

Ghassan El-Zein, PhD

Lebanese University, Faculty of Sciences

P.O. Box: 24

Maalaka, Zahle, Lebanon

Tel:(961) 8 80 68 49

E-mail: elzeingh@ul.edu.lb

Manal Nader, PhD.

The University of Balamand

Deir El-Balamand, El-Koura, North Lebanon

Tel: (961) 6 930250 x-316

E-mail: Manal.Nader@balamand.edu.lb

have to do with consumer safety and that is an issue aquaculturists should be interested in. Other topics that might be tangential to some of our readers are articles on bait-fish or ornamentals. Both are produced by aquaculturists, though I suspect most of our readers are most interested in foodfish production. So, we are all over the aquaculture universe in our coverage, which should mean there is something for everybody.

So, keep those articles and comments coming. And don't forget to consider writing an article for the laboratory series. I know I speak for the entire editorial staff (total of three) when I say we enjoy providing the aquaculture community with information and we will continue to seek out interesting, and sometimes perhaps controversial, material to put between the pages of *World Aquaculture* magazine.

Notes

¹Robert R. Stickney is Editor-in-Chief of *World Aquaculture* magazine. Email: rstickney@aol.com

²An infomercial is a commercial that provides information on a product and its use but is also a sales pitch. Half-hour infomercials are commonly seen on television in the United States, particularly in the middle of the night. They provide a great cure for insomnia.