Development and outlook of Egyptian aquaculture

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• Fishery resources in Egypt
• Features of Egyptian aquaculture
• Fish consumption, trade and quality
• Issues of concern
• Egyptian aquaculture outlook
Fishery resources in Egypt
Fishery resources in Egypt

Mediterranean, Red Sea, River Nile & lakes are the main sources for capture fisheries.

Total fish production from all resources reached 1,371,975 tons in 2012.

Aquaculture contribution represents 74.2% of total fish production in 2012.

Egypt is the 8th globally in aquaculture.
Aquaculture development
World Bank Mission (1978): findings and recommendations

Potential acreage for aquaculture: 23,400 feddan*
Potential production from aquaculture 35,000 tons
Average production: 1.5 ton/feddan

- Tilapia 50%
- Mullet 30%
- Carps 20%

* Feddan = 4200 m²

The production of aquaculture reached about 30 folds of estimated production

However:
Average production from earthen ponds is almost as previously estimated
Species composition in the present is close to what was estimated
Building upon the World Bank mission, it became obvious there was a good aquaculture opportunity in Egypt.

The practice started with the use of traditional practices whereas inputs and so outputs were low.

No use of Nile waters, no use of agricultural land.

Capacity building and international experience played a major role in the development.

Rapid then remarkable development in aquaculture took place in mid 1990s.

Development has been credited to the all-male tilapia as well as to the commercial feed. Of course the well-trained personnel were behind all that.
Features of Egyptian aquaculture
Contribution of aquaculture and fishery in total production (2002-2012)

<table>
<thead>
<tr>
<th>Year</th>
<th>Aquaculture</th>
<th>Fishery</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td></td>
<td></td>
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<tr>
<td>2003</td>
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<td>2004</td>
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<td>2011</td>
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<tr>
<td>2012</td>
<td></td>
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</tbody>
</table>

Aquaculture and fishery have contributed significantly to total production, with fishery surpassing 50% and reaching over a million ton in some years.
# Egyptian aquaculture (Global perspective – Top Ten- 2011)

<table>
<thead>
<tr>
<th>Country</th>
<th>Production (ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>38,621,269</td>
</tr>
<tr>
<td>India</td>
<td>4,573,465</td>
</tr>
<tr>
<td>Vietnam</td>
<td>2,845,600</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2,718,421</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>1,523,759</td>
</tr>
<tr>
<td>Norway</td>
<td>1,138,797</td>
</tr>
<tr>
<td>Thailand</td>
<td>1,008,049</td>
</tr>
<tr>
<td>Egypt</td>
<td>986,820</td>
</tr>
<tr>
<td>Chile</td>
<td>954,845</td>
</tr>
<tr>
<td>Myanmar</td>
<td>816,820</td>
</tr>
</tbody>
</table>
### Features of Egyptian aquaculture (narrow production basket)

<table>
<thead>
<tr>
<th>Species</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ton</td>
<td>%</td>
<td>ton</td>
</tr>
<tr>
<td>Tilapia</td>
<td>557049</td>
<td>60.58%</td>
<td>610617</td>
</tr>
<tr>
<td>Mullet</td>
<td>116029</td>
<td>12.62%</td>
<td>114001</td>
</tr>
<tr>
<td>Carps</td>
<td>191721</td>
<td>20.85%</td>
<td>203662</td>
</tr>
<tr>
<td>Others</td>
<td>54786</td>
<td>5.95%</td>
<td>58540</td>
</tr>
<tr>
<td>Total</td>
<td>919585</td>
<td>100%</td>
<td>986820</td>
</tr>
</tbody>
</table>

Egypt is the world second in regard to tilapia production and first in mullet production (China has the lead for tilapia).

Others contain marine finfish, marine shrimp, African catfish, and eels.
Composition of others in 2012 (52268 tons)

- Bass & bream: 28604 tons
- Meagre: 14236 tons
- Shrimp: 8319 tons
- Catfish & others: 1109 tons
Tilapia is a limiting species (intolerance to cold) – Because of that:

- Growing season starts when temperature warms up (April)
- Peak of harvesting (October – December/January)
- Farms which have warm ground water enjoy flexible management systems
- Greenhouses (hatcheries): Starting activities during winter months and provide tilapia fry in April when outdoor temperature warms up
- Open tilapia hatchery – in hapas - operates during late spring and ends by end fall
Fish farming and tilapia

Tilapia (harvesting)

Over-wintering of tilapia

All-year round tilapia farming (well water)
## Facts – Total fish production (ton)

<table>
<thead>
<tr>
<th>Year</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishery</td>
<td>431123</td>
<td>393494</td>
<td>349553</td>
<td>375894</td>
<td>372491</td>
<td>373815</td>
<td>387398</td>
<td>385209</td>
<td>375354</td>
<td>354237</td>
</tr>
<tr>
<td>Aquaculture (%/total)</td>
<td>444867 (50.78)</td>
<td>471535 (54.51)</td>
<td>539747 (60.69)</td>
<td>595029 (61.28)</td>
<td>635517 (63.04)</td>
<td>693815 (64.98)</td>
<td>705490 (64.55)</td>
<td>919585 (70.47)</td>
<td>986820 (72.44)</td>
<td>1017738 (74.18)</td>
</tr>
<tr>
<td>Total</td>
<td>875990</td>
<td>865029</td>
<td>889300</td>
<td>970923</td>
<td>1008008</td>
<td>1067630</td>
<td>1092888</td>
<td>1304794</td>
<td>1362174</td>
<td>1371975</td>
</tr>
</tbody>
</table>

**Source:** General Authority for Fish Resources Development, Yearbook statistics
Since mid-1990s, aquaculture witnesses periods of sharp increase or slight increase.

**BUT**

Never decreased till now.

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Production economics is the key factor in determining the mode of production and so the degree of development.
Aquaculture types – earthen ponds

Earthen ponds are the main aquaculture producer: 729,921 tons; 72% of total production in 2012.

Any improvement in pond productivity will be felt on the national level.

Total acreage of earthen ponds amounted to 285,833 feddans (120,050 hectares) in 2011.

>95% of pond acreage belongs to the private sector.

Owned land represents 14% of the total area; the remaining areas are either leased or utilized temporarily for aquaculture.

Productivity varies significantly.

Earthen ponds: Will remain the main production system (for economic reasons).
Other aquaculture types

- Intensive farms
- Cages
- Integrated rice-fish
Nile cage aquaculture
Banning/Piloting

Damietta/Rosetta Branches
(banned – lifted)

In operation:
Rayaan (Fayoum)
Behira
Emerging systems (desert aquaculture)

**Advantages:**
- All-year production
- A promising system for export
- Usually integrated with other plants and/or livestock

**Limitation:**
- Sustainability of underground water
- How construction costs

Fresh or Marine
Fish seed collection

The only source for mullet farming (no commercial mullet hatchery – some trials)

Same is true for European seabass and gilthead seabream (few millions are hatchery produced)

Collected fry is on the decline (62 million in 2011 compared to 148 million in 1990)

Negligible numbers of seabass, seabream and meagre are collected from the wild (omitted in 2011 statistics)
Where collected fry goes?

Aquaculture
Stocking of natural waters

There is always a debate between fishermen and fish farmers about fry collection.

Fishermen claim the harm on capture fishery due to the collection of wild fry.

Fish farmers claim that higher survival and biomass are achieved in aquaculture facilities.

The value of stocking programs requires validation otherwise biased opinion may develop.
Since 1990, the use of herbicides in the control of aquatic plants in the River Nile and irrigation canals has been banned.

Instead, the use of grass carp, *Ctenopharyngodon idella* has been introduced as a biological control agent.

The Channel Maintenance Research Institute (CMRI) of the Ministry of Water Resources and Irrigation is in charge of the program (seed production and release)- Grass carp seeds are produced in collaboration with governmental hatcheries.

Two components are needed to supplement this program:
Impact assessment
Creating awareness and introduce catch and release concept among fishermen
About 110 tilapia hatcheries operate in the present with the dominance by the private sector. Realistically, actual tilapia fingerlings should exceed by far the reported 247 million in 2011.

Fingerlings of carps are produced mainly in governmental hatcheries with a total of 213 million in 2011 of three species (common, silver and grass carp). Most of common carp fingerlings are produced for rice-fish culture. About 77 million of grass carp fingerlings are produced for the biological control of aquatic plants (in 2011)

Few marine hatcheries are in limited operations (15 million in 2011). Most of the recent increase is credited to shrimp.
Fish feed industry

Fish feed is more directed towards tilapia
A growing industry (about 500,000 tons at present) produced by feed mills with different capacities and technologies
Most of feed ingredients are imported
Some feed mills have got “Good Manufacturing Practices” standards
Active joint venturing with international companies is now in place
Some feed is exported to Arab and African countries.
Some specialized feed is imported for marine fish/shrimp
Fish consumption, trade and quality
The Per capita fish consumption in Egypt is close or slightly exceeds the world average (about 16 kg/2011). The national strategy aims to maintain the world average from local production by 2017.

Fish import fills the gap between national production and consumption (390,605 tons in 2010 and 182,222 tons in 2011). Foreign exchange rate influences fish importation.

Only a modest quantity of marine capture fishery is exported (9,489 tons in 2011). Most of the exports are Mediterranean fish.
# Fish trade - quantities of fish import & export (ton)

<table>
<thead>
<tr>
<th>Fishery resources</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local production</td>
<td>1008008</td>
<td>1067630</td>
<td>1092888</td>
<td>1304794</td>
<td>1362174</td>
</tr>
<tr>
<td>Imports</td>
<td>258931</td>
<td>136807</td>
<td>135523</td>
<td>256813</td>
<td>182222</td>
</tr>
<tr>
<td>Exports</td>
<td>4417</td>
<td>6727</td>
<td>7594</td>
<td>10596</td>
<td>9489</td>
</tr>
<tr>
<td>Available for consumption</td>
<td>1262522</td>
<td>1197710</td>
<td>1220817</td>
<td>1551011</td>
<td>1534907</td>
</tr>
</tbody>
</table>

**Source:** General Authority for Fish Resources Development, Yearbook statistics

Importing cold water fish is required in some markets & needed for smoking. Importing species of production shortage is quite normal (e.g. shrimp). However, importing tilapia is a real concern.
The central fish market “Obor” is located in Cairo. The market receives fish from various sources (capture fishery, aquaculture, and imports).

The wholesale fish market in Kafr El Sheikh has been established to serve the fish trade in the governorate especially about 44.1% of total fish in Egypt in produced in Kafr El Sheikh; out of which 496,706 tons from aquaculture which represents 50.3% of total Egyptian aquaculture (2011). From this market, fish is distributed within and outside the governorate based on demands.

Auctioning is the system practiced in the central/wholesale markets whereas a fixed fee is deducted from the sale transaction against the market service.
Retail fish marketing

Retail shops provide fish to consumers directly.
Retail shops vary in size and in fish displayed.
 Depending on locations, purchasing power and preferences of consumers, fish demand and supply varies.
In coastal areas, marine fish and shell fish will be displayed more compared to the delta regions whereas tilapia and mullet are more common.
Retail shops are either clustered in bigger markets or could be individually located where the demand exists. Weekly village markets are very important in fish marketing.
Large supermarkets often display fish of different species & in different types of preparations.
Marginal fish sale

It is common to find individuals selling fish along main roads especially close to lakes. Those could be related to fishermen or just an individual job. Interestingly, many buyers believe more in the freshness of these fishes based on the closeness to the fishery resources.
Quality awareness is steadily developing among producers and consumers over time.

The competition among producers led to new marketing initiatives (e.g. out-of-season marketing).

Improving fish quality is more adopted when associated with economic returns such as live fish marketing.

Media plays an effective role in that issue and may discourage fish consumption whether based on true information or on rumors.
The main types of fish processing in Egypt are:

**Salting:** this is mainly applied to mullets (*Mugil* sp.) to meet the peak of demands during the eastern. The sources of mullets for salting are either capture fishery or aquaculture. Few processors label their salted mullet in order to enable the display of their products in supermarkets and also in regional markets. On-boat salting is also done on several species of Lake Nasser catch including *Alestes* sp., *Labeo* sp., *Hydrocynus* sp., and *Eutropius niloticus*. Wild caught sardines are also salted.

**Smoking:** smoking is performed on imported frozen fish of cold water species (herring like species). A trial was done on African catfish and common carp but was never commercialized.

**Filleting:** performed mainly on large-size tilapia and Nile perch from Lake Nasser and few of Red Sea species such as grouper. Fish fillets (fresh/frozen) aim to meet market demands as well as to achieve efficient transportation to target markets.
Issues of Concerns
## Limitation of natural resources

<table>
<thead>
<tr>
<th>Water</th>
<th>Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe competition on water use especially the per capita water consumption is 680 m$^3$/year (1000 m$^3$/year is the water poverty limit).</td>
<td>Almost all suitable land for fish culture are being already utilized as fish farms.</td>
</tr>
<tr>
<td>Agricultural crops enjoy priority over aquaculture in regard to water use.</td>
<td>Converting the temporarily fish farms into agriculture after salt washing –if happened- would significantly reduce the acreage of fish farms and so fish production.</td>
</tr>
<tr>
<td>There is some of unutilized water resources (under-ground, brackish, marine).</td>
<td>Desert when used for aquaculture requires much higher investments.</td>
</tr>
</tbody>
</table>
Legislations on the use of natural resources

Water

With the exception of freshwater hatcheries, farms are not entitled to use river waters.

Only agricultural drainage water is allowed in fish farms. Ensuring that water should be safe.

Even though the use of brackish water in northern delta is encouraged, roads, power and other utilities are needed.

Land

The lease term was five years and then ten years. Because most of fish farms are on leased lands, longer lease term encourages the investments as well as benefitting of available credit lines. Recently, the lease term has been extended to 25 years conditioned to good farming practices.

Aquaculture should not be practiced over agricultural land. Hence, once the salt content of the temporarily fish farms is washed up, these farms should turn into agriculture.
Dealing with the limitation of natural resources (water & land)

Adopting any of the following scenarios:

Intensification of farming practices whenever found economically feasible.

Wiser use of natural resources through integration and/or rotation.

Introducing and promoting new initiatives such as aquaponics.

Focus on means for the utilization of under-utilized water resources especially marine or brackish water.
Water scarcity and aquaculture: Intensification

Intensification trend is widely adopted under the limitation of land/water
Rice-fish culture

A large-size national program supported by the government with a total production of about 15,000 tons of common carp

Common carp fingerlings are provided at no cost

Integration with agriculture

The integration with horticulture is in practice (banana, guava, mango)

Also with vegetable & alfalfa

Reduced chemical fertilization & enhance product quality
Water scarcity and aquaculture: Rotation with strategic crops (wheat & alfalfa)

Promoting integration and rotation (e.g. wheat and alfalfa)
Began shy but now expanding (win-win situation)
Still relatively insecure according to the Law 124
No available figures about its size – **Positive indications**

Added value to fish farming water is a fact – quantifying that still based on field observations
Water scarcity and aquaculture: Use of under-utilized brackish water

Not commonly practiced
Accidently explored (olive farm)

A promising source subject to:
  Sustainability of water resources:
    Seems abundant (solid information)
Availability of key infrastructure (especially roads and power)
Soil structure in the location
Longer lease term & reasonable fees
Aquaponics

Starts at experimental level
Expanding at a slow rate
Great chance for dissemination
Greater potential whenever water gets scarce

Example of tested crops
Screening will be based on production economics
Farm economics – High cost of feed

Most feed ingredients are imported and so influenced by the foreign exchange.

Over a 9-year period:
Feed prices increased by 284% while fish prices increased by 152%.
How could farmers survived the high feed cost?

- Accepting lower profits compared to before
- Increase the productivity/unit area (conditioned to economics)
- Enhance the utilization of feed
  - Better feed quality/better water stability
  - Reduce feed wastes (quality, feeders)
  - Reliance of natural food for sufficient time before administering commercial feed
  - Attempting to introduce non-feed consuming species such as silver carp (did not work as hoped)
  - Improving tilapia marketing and revenue (live fish marketing)
- Not much to do except waiting for the best which could be a function of others (price increase of red meat; bird flu)
- Attempting to use non-conventional ingredients was not practical due to wrong choices
Production basket: Expanding the basket

A growing interest in the farming of some native species (e.g. African catfish and Nile perch).

The availability of Nile perch seed and the low marketability of African catfish represent a major constrain.

Expanding production basket could be partially addressed through processing and added value products.

Hatchery technology has not developed yet

Seed production is now possible; Catfish is not enjoying enough consumer acceptance
Production basket: Promoting marine aquaculture (1)

Present production of marine species is far below potential.

The competition among various sectors (e.g. tourism) represents a main obstacle hindering the development of marine aquaculture.

Most of marine fish could be marked locally especially some importation takes place (e.g. shrimp).

Ability to export should consider international competition.
Existing marine aquaculture initiatives is sufficient to start with especially hatcheries and feed mills.

Adequately trained human resources are available to start with.

Land-based farms on brackish & marine water is a promising once technically and economically justified.

Off-shore cages is getting more attention in the present and is now in the piloting phase.
Farming of European eels is practiced in several farms in one region.

Eel farming is stimulated by:

- availability of elvers
- market demand – high market price
Training is a regular component in governmental programs (in-country and overseas)

Private programs supported the training of different stakeholder categories (farmers, officials, processors)

Training for producers tried to cope with the development and difficulties of the sector

Training the trainers was found very effective (governmental & academic staff)
Multi Sector Support Programme (MSSP), (1996-2004) was initiated by the Ministry of Agriculture and was funded by the European Commission (EC).

The program was designed to provide soft loans with interest rates considerably lower than the commercial interest rates to four agricultural sectors including aquaculture.

Technical assistance was provided to ensure successful implementation of credits.

Upon the completion of MSSP, the program has undergone some modifications and merging resulting in ASDP, ARDF and finally ADP programme. However, providing soft developmental loans continue to be the key activity of the program.

Soft loans are also provided by the Social Fund for Development (SFD)
Governing regulations

Laws, decrees and regulations to address:

Water and land use

Establishing and licensing of a fish farm/hatchery

Law of Environment (discharge of effluents)

Introduction of non-native species

Use of veterinary drugs and chemicals (banning some chemicals such as sex reversal hormone and antibiotics)

Feed manufacturing and additives
Several species were introduced for aquaculture and are well established:

- Common carp
- Silver carp
- Grass carp
- Bighead carp

For biological control
- Mosquito fish for malaria control
- Black carp for bilharzia (research)

For aquaculture
- Freshwater prawn (experienced marketing difficulty)

Wrong aquaculture choice
- Red swamp crayfish
Targeted fish production of 1.5 million tons from all resources by 2017 seems achievable earlier.

No matter how production diversification is required, tilapia will continue to be the leading species.

Economic intensification is not an option.

Various models of integration at different scales are expected to spread out.

As competition gets stronger, quality issue of fish products should be more important.
About a million tons of fish feed will be needed by 2017

A part of the feed should target marine fish and shrimp

The local market will remain the focus of fish production with some exports of species and types where relative advantage exists (e.g. chilled tilapia fillets)

Practicing the farming of bivalve and oyster is expected even for export

Research should be working closely with production systems

Extension service needs more support and should be engaged with producers, researchers and carried out by well trained staff