Small and medium scale aquaculture value chain development in Egypt: Situation analysis and trends

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Small and medium scale aquaculture value chain development in Egypt: Situation analysis and trends

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Executive summary

This report provides a situational analysis of the Egyptian aquaculture value chain conducted in 2013/2014. It deals with the conditions within which the farmed fish value chain operates in Egypt and the general trends that exist in the environment.

Fisheries and aquaculture comprise about 6.7% of the total value of agricultural production in Egypt (in 2010/2011). Volumes produced through aquaculture have exceeded capture fisheries production since 2003 and the sector has seen impressive growth, which reached 1 million tonnes in 2012. The main cultured species in Egypt are Nile tilapia, mullet, carps and African catfish. The majority of fish is produced in earthen ponds but other systems are also in use. The intensity of production is increasing, with higher volumes coming from smaller land areas under production. There are strict policies in place that govern aquaculture with regard to the use of land for fish farming and water usage. These limit the further expansion of aquaculture areas. Imports of fish into Egypt have been reasonably steady over the years in terms of volume, while the value of imports has increased. Exports are small in comparison and the net trade balance is negative: 183,970 t in volume and USD 513.45 million in value.

In the Egyptian diet in 2009, total animal protein was comprised of approximately 22% of fish and seafood. Expenditure on food is still a major proportion of Egyptian households' total expenditure. However, there is variation between rural and urban areas. Rural households spend less on food in absolute terms but more compared to their total expenditure when compared to urban households. Expenditure on fish is about 6% of total expenditure in rural areas and 7% in urban areas, and this has been stable over the years, although expenditure in absolute terms has increased substantially. Steady population growth has spurred demand for food. However despite income growth, as reflected in rising GDP, poverty, malnutrition and food insecurity are still common issues in Egypt, as inflation has put upward pressure on the cost of an average food basket.

Until recently, fish health has not been considered as a major issue in the value chain, as most Egyptian fish farms are not very heavily stocked. However, the gradual process of intensification and poor water quality in many of the fish farm areas means that disease outbreaks can occur, with considerable loss of stock. While the responsibility for fish health management falls with General Organization for Veterinary Services (GOVS), in practice most support is provided by private veterinarians or pharmaceutical suppliers, with some support from Central Laboratory for Aquaculture Research (CLAR).

There are a large number of private hatcheries that provide Nile tilapia seed, although the majority of these are unregistered. Some hatcheries have tried to improve the genetic potential of Nile tilapia, but farmers continue to buy seed based on the lowest price. An improved tilapia strain that can potentially bring substantial yield gains has been developed by WorldFish and partners and has begun to be disseminated through private hatcheries. Farmers appear to be keen to stock the improved strain although it is unclear whether they will be willing to pay a higher price for this seed. Other important actors in fish breeding include the government's Central Laboratory of Aquaculture Research, the Institute of Oceanography and Fisheries and university institutes and departments.

Feed is the major cost contributor in the production of farmed fish and demand for feed is high. As a result, many formal and informal feed mills have been established in recent years. Feed ingredients are mainly imported and costs are rising, exacerbated by declining terms of trade as a result of rising foreign currency exchange rates. Despite this, imports of soya tripled in volume terms between 2000 and 2012, and corn imports increased, while fishmeal imports declined. The rising prices of feed have not been accompanied by equal rises in the price of the final product which has been putting pressure on farmers' profit margins.

Extension and training for farmers has mainly come from GAFRD and from WorldFish. The SDC-funded IEIDEAS project has made a substantial contribution to capacity development through the provision of training using a training-of-trainers approach. The aim is to deliver a complete suite of short, field-based training sessions to 3000 fish farmers by the end of 2014. For many fish farmers, this is the first time that they have received any form of training or advice.

Credit is available to farmers through the state-owned Bank for Development and Agricultural Credit. The fisheries and aquaculture sectors access only a small proportion of loans. Private and state-owned banks are reluctant to lend to the aquaculture sector because of the perceived high risk involved and lack of available collateral. Most land is rented from GAFRD, but conditions of lease are variable. Many farms are not licensed, providing another disincentive for banks to give loans to fish farmers. Obtaining a new farm license is challenging for farmers due to the many government departments involved and the limitations in land use. The limitations in accessing bank loans has resulted in many fish farmers obtaining credit from feed mills/traders and/or from fish traders/wholesalers in order to cover the cash-flow requirements of the business. These dependency relationships may result in benefits to fish traders and feed sellers, but are often to the detriment of farmers.

Fish is mainly sold whole and there is very little processing in the farmed fish value chain. Whole fish is usually packed with ice but transport and market conditions are generally poor and the quality of the product deteriorates fast. The market is controlled by a limited number of large wholesalers who determine the market prices. In major cities there is usually a wholesale market. Some farmers can be 'locked in' to a wholesaler or a feed supplier through the provision of loans or other forms of credit, and in such cases, farmers pay higher sales commission or feed prices, and may be obliged to harvest at suboptimal times. Street-side retailers, many of whom are poor women, buy their fish from wholesalers. This group is often vulnerable as they buy fish on a one-day credit from wholesalers, and operate under poor conditions. There have been some attempts at value addition and marketing through supermarkets but this is a small proportion of total volumes being sold. Some fish is sold live through specialized traders.

The policy framework for implementation of food safety measures in the farmed fish value chain is limited. Where a legislative framework is in place (e.g. for residue control for exports) this has limited implementation. While there are many concerns about the fact that farmed fish is grown in agricultural drainage water, preliminary studies by WorldFish and Livestock and Fish CGIAR Research Program Safe Food, Fair Food project indicate that any contamination levels are extremely low, well below the levels that cause concern.

While the aquaculture sector has shown strong growth in the past decade, especially compared with other agricultural subsectors, the competitiveness of the sector is perceived to be under threat by steadily rising production costs coupled with limited increases in fish market prices.

A complex set of laws related to environmental impacts governs the value chain. These relate to the management and use of water resources.

A strategy for sustainable agriculture has been developed by the Egyptian government in collaboration with FAO and IFAD to encourage growth in the sector. For aquaculture, the target is to increase production from the present 1 million tonnes to 1.39 million tonnes by 2030.

A wide range of organizations are involved in aquaculture research and development. The main regulatory agencies are in the Ministry of Agriculture and Land Reclamation. GAFRD issues aquaculture licenses and leases land to fish farmers while providing extension advice. The Central Laboratory for Aquaculture Research (CLAR) carries out research programs on all aspects of aquaculture and the General Organization for Veterinary Services (GOVS)

provides fish health support and is the competent authority for fish exports. Several Egyptian universities have undergraduate and postgraduate research programs including: Suez University, Cairo University, Zagazig University and Kakr El Sheikh University.

The main opportunities for pro-poor fish value chain research and development are to support sustainable and equitable growth of the value chain. It already supports employment; and provides incomes and fish supplies for poor Egyptians. Further growth should focus on how the benefits from continued sustainable growth can help to alleviate poverty and provide nutrition to Egypt's 25 million poor people.

Preamble

Conducting a situational analysis is a standard procedure in the Livestock and Fish CGIAR Research Program. The program works with specific livestock and fish value chains in a number of selected focal countries. The main objective of the situational analysis is to assess the conditions within which the target value chain operates in a selected country. This will set broader national contexts for value chain assessments and analysis at site or small geographical scales through the subsequent research activities. Following the notion of situational analysis, the assessment exercise will involve overviews of past trends, current status, and likely future directions in the sector. The scope of the assessment is determined by the 'conditions' we set out to assess. The structure or content of the situational analysis will follow stage-by-stage assessments of different segments of the value chain under study. Any data and analysis should include a gender dimension where possible.[1] This is a living document as the policy context is likely to change during the program period.

1 http://livestock-fish.wikispaces.com/Situational+Analysis+Report.

Abbreviations

AHRI	Animal Health Research Institute
ARDC	Agricultural Research and Development Council
ARDF	Agricultural Research and Development Fund
CAPMAS	Central Agency for Public Mobilization And Statistics
CBE	Central Bank of Egypt
CLAR	Central Laboratory for Aquaculture Research
CPI	Consumer Price Inflation
CRP	CGIAR Research Program
EEAA	Egyptian Environmental Affairs Agency
EIA	Environmental impact assessment
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FFFA	Fayoum Fish Farmers Association
FTE	full-time employment
GAFRD	General Authority of Fish Resources Development
GDP	Gross Domestic Product
GOVS	General Organization for Veterinary Services
HIECS	Household Income, Expenditure and Consumption Survey
IDSC	Information and Decision Support Center of the Cabinet
IEIDEAS	Improving Employment and Income through Development of Egypt's Aquaculture Sector (project)
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
LE	Egyptian Pounds
MoALR	Ministry of Agriculture and Land Reclamation
MHUNC	Ministry of Housing, Utilities and New Communities
MoEA	Ministry of Environmental Affairs
MoHP	Ministry of Health and Population
MSSP	Multi Sector Support Program
MWRI	Ministry of Water Resources and Irrigation
NALO	National Aquaculture Legislation Overview (FAO)
PBDAC	Principal Bank for Development and Agricultural Credit

QCAP	Central Lab of Residue Analysis of Pesticides and Heavy Metals in Food
SADS	Sustainable Agricultural Development Strategy
SFD	Social Fund for Development
TCE	Total consumption expenditure
WFP	World Food Programme

Background

Aquaculture plays a major role in supplying affordable animal protein for Egyptians and current policies support intensification and higher production levels. Egypt is among the ten largest producers of farmed fish (mostly tilapia) globally (FAO 2012). The 2030 Egyptian sustainable agriculture strategy (Abul-Naga 2009) lists fish production as the second highest priority, after dairy production, as an animal protein source. Aquaculture is recognized as an important source of labour, currently providing employment for 14 full-time equivalents (FTE) for every 100 t of fish produced and sold. Employment is fairly evenly divided between those over and under 30 years of age and is mostly made up of men, although there is some female employment in the retail subsector. Considerable additional indirect employment results from the production of inputs used in the value chain i.e. jobs in feed mills, hatcheries and ice plants; suppliers of vehicles, water pumps and generators ;building contractors; and manufacturers of boxes used during transport (Macfadyen et al. 2012).

Demand for fish exceeds supply for most of the year and the challenge is to spread production more evenly to match an oversupply at the end of the year. The current economic situation means that Egypt cannot rely on imports (import tax rates have recently been raised) and must seek to further boost homegrown aquaculture products. Aquaculture could generate exports if the appropriate frameworks are put in place.

The political situation in Egypt remains uncertain in the short- and medium-term although the security situation appears to be stabilizing in recent times. The locally owned food sector has not been severely impacted so far and it remains important to build private sector capacity such as producer organizations (D'Alessandro and Abdelaal in preparation).

It is important to maintain good relationships with all key partners including government counterparts through this period to enable project and value chain work to continue. Although the country is facing an economic crisis, the government has honoured its financial commitment to CGIAR for 2013, despite the difficult economic conditions. This implies that there are good prospects for the sector to continue to grow.

The product

Agriculture is one of the most important national economic sectors, employing 27.1% of the national work force in 2012. The sector contributed 13.4% of gross domestic product (GDP) in 2011/2012 and achieved a growth rate of 2.9% (with constant prices) in 2011/2012 (CAPMAS 2013).

Between 2005–2006 and 2010–2011, the total value of agriculture production increased by 81.9%, representing an average annual growth rate of 16.4%. Plant, livestock and fish production constituted 59.4, 33.8 and 6.7%, respectively of the total value of agriculture production; the three subsectors seeing annual increases of 17.9, 14.1 and 16.2% over the same time period (Table 1).

Table 1. Total value of agricultural production and annual growth rate, 2005/2006–2010/2011

Item	Value 2010/2011 (million LE)	% of agriculture production value	Total growth rate (%)	Annual growth rate (%)
Value of livestock production	84,538	33.80	70.50	14.10
Value of plant production	148,501	59.40	89.40	17.90
Value of fish production	16,819	6.70	80.70	16.20
Value of insect products	131	0.05	11.00	2.21
Total value of agricultural production	249,989	100.00	81.90	16.40

Source: CAPMAS (2013) author's calculations.

While the CGIAR Research Program on Livestock and Fish is concerned with aquaculture produced (i.e. farmed) fish, Egyptian fish production is sourced from both capture fisheries (inland and marine) and aquaculture. Total fish production increased from 724,300 t in 2000 to 1,362,174 t in 2011. The increases were primarily due to significant increases in aquaculture, which represented 72.4% of total production in 2011, compared to 47% in 2000 (GAFRD 2012).

Egypt is a significant player in the global aquaculture industry and is ranked eighth in terms of quantity of production in 2011. It is by far the largest aquaculture producer in Africa (representing 64% of total African production in 2011). Egypt is the second largest producer globally of tilapia (after China) and the largest global producer of mullet (FAO 2012).

Nile tilapia (*Oreochromisniloticus*) is the predominant species produced in private sector freshwater or brackish water Egyptian fish farms. The second most important species are: mullets (*Mugilcephalus, Liza ramada*), followed by carps (*Cyprinuscarpio, Ctenopharyngodonidella, Hypophthalmichthysmolitrix, Hypophthalmichthysnobilis*) and African catfish *(Clariasgariepinus*). Other species produced in marine (salt water) fish farms include: seabass (*Dicentrarchuslabrax*), sea bream (*Sparusaurata*) and meagre (*Argyrosomusregius*).

Consumption and expenditure

Per capita supply of fish

Annual domestic per capita fish supply saw a steady increase from 12.45 kg in 2004 to 16.48 kg in 2012, a total increase of 32.4%, or an average of 0.50 kg/year. Fish imports per capita also increase in the same period from 3.15 kg to 4.07 kg per capita, or from 20.2% to 19.81% in total fish supply, total supply of fish therefore increased by 31.73% in the period 2004–2012 (Table 2). The increase is mainly due to rising aquaculture production, while imports remained more or less steady (see also Chapter 5).

Table 2. Local and total fish produced and imported per capita (in kg), 2004–2011

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Local fish per capita	12.45	12.60	13.67	13.69	14.20	14.23	16.66	16.82	16.48
Local and imported fish per capita	15.60	15.61	16.54	17.14	15.93	15.90	19.80	19.19	20.55

Source: GAFRD 2012.

The contribution of fish and seafood to per capita supply of food was estimated at 29 kcal/day in 2009, equivalent to 0.9% of total daily available energy and 10.1% of total energy from animal products. Per capita daily protein supply from fish and seafood was 4.8 g in 2009, making up 4.8% of total available protein and 22.3% of protein from animal source foods (Table 3).

Table 3. Per capita supply of food, protein and energy, 2009

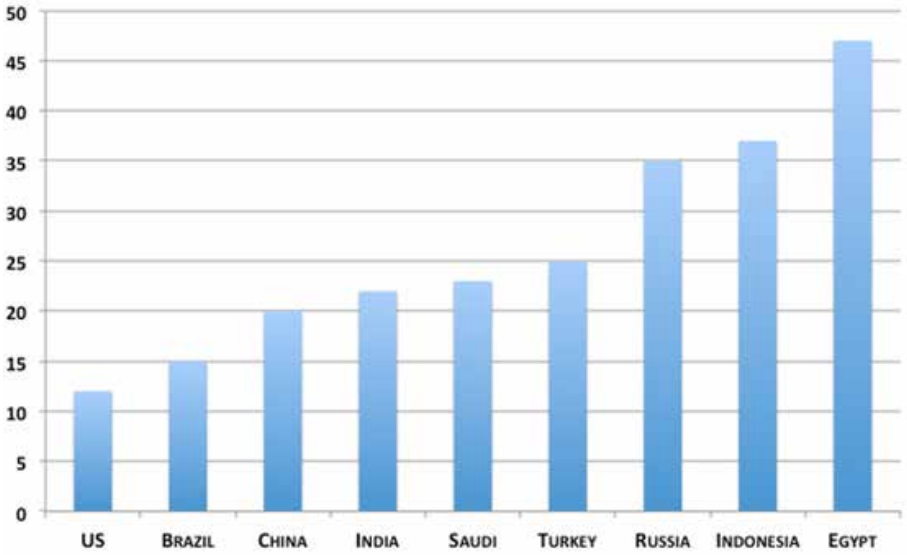
	Per capita supply									
	Total				Protein			Fat		
	kg/year	kcal/day			g/day			g/day		
		kcal	% of total food	% of animal prod.	g	% of total food	% of animal prod.	g	% of total food	% of animal prod.
Beef	12.3	49	1.5	17.0	4.5	4.6	21.3	3.3	5.8	16.1
Mutton and goat	1.8	11	0.3	3.8	0.7	0.7	3.3	0.9	1.6	4.4
Pork	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poultry	10.0	40	1.2	13.9	3.4	3.5	16.1	2.8	4.9	13.7
Eggs	3.3	13	0.4	4.5	1.0	1.0	4.7	0.9	1.6	4.4
Milk	59.3	90	2.7	31.3	5.4	5.6	25.6	6.0	10.6	29.3
Animal fats	2.4	46	1.4	16.0	0.1	0.1	0.5	5.2	9.2	25.4
Fish, seafood	16.8	29	0.9	10.1	4.7	4.8	22.3	1.0	1.8	4.9
Cereals	247.5	2171	64.8		59.0	60.8		15.4	27.2	
Fruit and vegetable	334.5	308	9.2		8.9	9.2		1.9	3.4	
Other food items	123.0	581	17.3		7.8	8.0		18.8	33.2	
Grand total		3349			97.0			56.7		

Source: FAO food balance, FAO STAT (2009) and author's calculations.
Note: Per capita supply is calculated as follows:
production + imports–exports + changes in stocks (decrease or increase) = supply for domestic utilization

Expenditure on food and fish

In Egypt food is a major component of household expenditure, accounting for almost 50% of household income in 2009, although this share seems to be declining somewhat. This can be considered high compared to a range of other countries in the world (Figure 1).

Figure 1. Food expenditure as share of family budget by country (%), 2009.



Source: Thompson (2012).

Table 4 shows per capita nominal total consumption expenditures and expenditure on food, meat, fish, and dairy products and eggs in urban and rural areas in 2004/05, 2008/09 and 2010/11. Between 2005 and 2011, expenditure on food in urban and rural areas increased by 72 and 84%, respectively. However, expenditure on food as a percentage of total expenditure decreased from 41.4 to 36.5% in urban areas and from 50.9 to 46.4% in rural areas over the same period. Total food, fish and seafood, and meat expenditure figures were higher in urban than in rural areas, while the food share in total consumption expenditure was higher in rural than in urban areas due to the lower expenditure levels in rural areas. From 2005 to 2011, expenditure in nominal money terms in rural areas increased by 101.4% on fish, 93.4% on meat, and 90.9% on milk products and eggs. Meanwhile equivalent expenditure in urban areas rose by 80.32, 72.9 and 69%, respectively (Table 4).

Table 4. Consumption expenditure on commodities by location, 2004/05–2010/11

Expenditure items (LE)	2004/05		2008/09		2010/11	
	Rural	Urban	Rural	Urban	Rural	Urban
Total consumption	1916	3256	2881	4787	3866	6340
Food consumption	976 (50.9%)	1346 (41.4%)	1450 (50.4%)	1913 (40.0%)	1795 (46.4%)	2312 (36.5%)
Meat	268 (27.5%)	387 (28.7%)	365 (25.2%)	510 (26.6%)	519 (28.9%)	668 (28.9%)
Fish	52 (5.3%)	94 (7.0%)	83 (5.8%)	138 (7.2%)	105 (5.8%)	169 (7.3%)
Dairy products and eggs	102 (10.4%)	194 (14.4%)	166 (11.5%)	283 (14.8%)	194 (10.8%)	328 (14.2%)

Source: CAPMAS (2006, 2009, 2012a) and author's calculations.

Although people are spending more in real terms on fish, expenditure on all types of animal sourced proteins are increasing at more or less the same pace. Thus there seems to be limited dietary change overall. Large variations between governorates exist, with Damietta, Port Said, El Bahr El-Ahmer, North Sinai and Kafr El-Sheikh with the highest fish and seafood expenditure percentage (respectively 17.0, 14.7, 11.9, 10.5 and 10.0% of the total food expenditure), while Fayoum, BeniSeuf, Aswan, Qena and Monufia governorates have the lowest fish and seafood expenditure (ranging from 5.82 to 6.59% of total food expenditure) (HIECS 2010/2011).

Factors influencing consumption trends

Consumer perceptions

There is a widespread perception, particularly among rich consumers, authorities and some scientists, that farmed fish contains high levels of pollutants such as heavy metals, pesticides and hormones. This is based on concerns about water quality, as legally, fish farms must use water from agricultural drainage canals or from lakes, rather than freshwater directly from the irrigation system or the Nile. The limited amount of laboratory testing carried out so far indicates that poor water quality is not an issue. Tests carried out on farmed fish by the IEIDEAS project in collaboration with ILRI food safety projects found that in most samples, contaminants were not detected or were below the level of quantification (LOQ). In the few samples where contaminants were above LOQ, they were well below permissible limits.

However, even if the science says that farmed fish is safe, the sector as a whole faces challenges in changing perceptions, particularly for middle-class consumers. Macfadyen et al. (2012) suggested that the sector needs generic advertising and marketing campaigns using mass media e.g. radio, television, billboards, newspapers etc. to influence demand (and therefore price) to change consumer perceptions about the quality of fish and the health benefits of eating fish.

Population growth and urbanization

Population growth, increasing urbanization and rising incomes are the main causes of dietary changes. Urban, rural and total populations from 2000 to 2012 are shown in Table 5. This shows that the total population increased by 24.1% over this period, which was equally spread across rural and urban populations.

Table 5. Estimates of mid-year urban and rural populations, 2002–2012

Year	Urban		Rural		Total (000)
	No. (000)	%	No. (000)	%	
2002	28,554	42.9	38,074	57.1	66,628
2004	29,653	42.8	39,651	57.2	69,304
2006	30,585	42.5	41,424	57.5	72,009
2008	32,249	42.9	42,945	57.1	75,194
2010	33,804	43.0	44,881	57.0	78,685
2012	35,373	42.9	47,177	57.1	82,550

Source: CAPMAS Yearbook (2013).

There are regional variations in the distribution of urban and rural population. Table 6 reveals that the largest proportion (44%) of urban population lives in the urban governorates, while 54% of the total rural population is located in the Lower Egypt governorates. The frontier governorates are inhabited by less than 2% of the total population.

Table 6. Population in governorates (urban and rural), 2006

Governorates	Urban population		Rural population		Total population	
	No. (000)	%	No. (000)	%	No. (000)	%
Urban[1]	13,874	44.0	2385	5.8	16,260	22.3
Lower Egypt[2]	8767	27.9	22,528	54.4	31,295	43.0
Upper Egypt[3]	7852	25.0	16,098	38.9	23,950	32.9
Frontier[4]	878	2.8	415	1.0	1293	1.8
Total	31,371	100.0	41,426	100.0	72,798	100.0

Note: 1. Urban Gov.: Cairo, Alexandria, Port-Said, Suez, Halwan and 6 October; 2. Lower Egypt Gov.: Damietta, Dakahlia, Sharkia, Kalyoubia, Kafr El-Sheikh, Gharbia, Menoufia, Behera and Ismailia; 3. Upper Egypt Gov.: Giza, Beni-Suef, Fayoum, Menia, Asyout, Suhag, Aswan and Luxor; 4. Frontier Gov.: Red Sea, El wadi El-Gadid, Matrouh, North Sinai and South Sinai. Source: CAPMAS, Yearbook, 2013.

The population distribution may have implications for demand for different fish types and sizes due to differences in consumer preferences. For example, there is high demand for catfish in the Upper Egypt governorates, while urban governorates have lower demand for species such as tilapia. These preferences are reflected by differences in fish prices in different locations (Table 7).

Table 7. Beef, poultry and tilapia fish price by region (in EGP/kg), Sept 2012–Sept 2013

		Urban	Lower	Upper	Frontier
September 2012	Beef	61.6	59.9	52.7	60.0
	Poultry	17.7	16.2	17.3	18.9
	Tilapia fish	12.3	12.1	15.9	15.0
December 2012	Beef	60.9	58.5	56	60.3
	Poultry	17.0	15.6	16.9	16.2
	Tilapia fish	12.1	11.6	15.4	16.2
March 2013	Beef	61.5	60.1	53.4	59.2
	Poultry	20.6	19.2	19.9	19.1
	Tilapia fish	13.4	13.0	16.1	15.3
July 2013	Beef	66.3	61.2	54.0	60.9
	Poultry	20.4	19.1	20.0	20.5
	Tilapia fish	13.8	13.8	16.5	15.6
September 2013	Beef	65.7	60.8	56.7	62.0
	Poultry	19.6	18.8	19.5	20.8
	Tilapia fish	13.3	13.5	16.2	16.4
% change in price from 09/2012 to 09/2013	Beef	6.0	1.5	7.6	3.3
	Poultry	10.0	16.0	12.7	10.1
	Tilapia fish	8.0	11.0	1.0	9.3

Source: CAPMAS, Yearbook(2013).

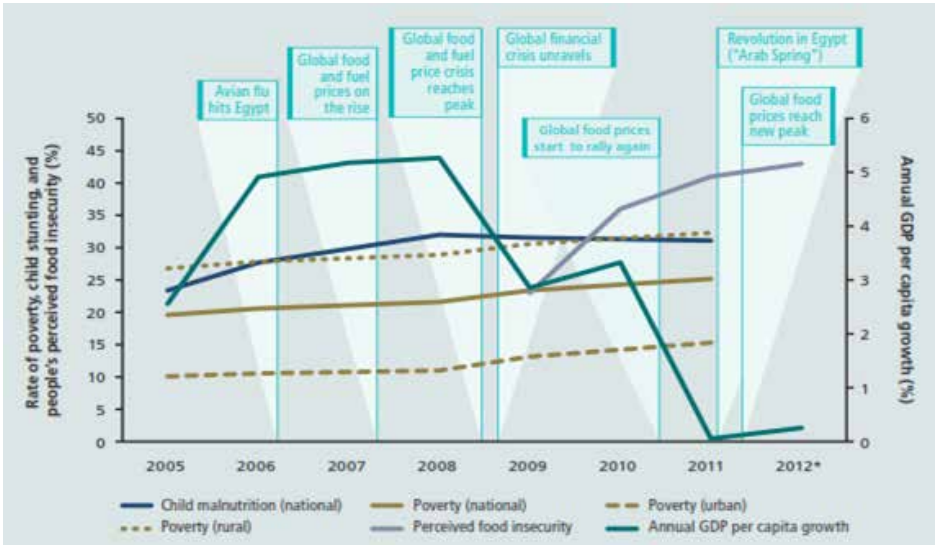
Income and poverty

While per capita GDP increased from EGP 5604 in 2000 to EGP 7235 in 2012, representing a total increase of 29.1% or EGP 172 (2.57%) per year (FAOStat), new estimates from 2010/2011 Egypt's Household Income, Expenditure and Consumption Survey (HIECS) show that income poverty increased from 19.6% in 2004/2005, to 25.2% (21 million people) in 2010/2011 (Figure 2). Between 2009 and 2011, 15.2% of the population (12.2 million people) fell into poverty, double the percentage of those who moved out of poverty (7.7%), and a further 12.6% of the population remained in chronic poverty. There is a significant correlation between income poverty and poor access to food, highlighting that food security in Egypt remains an issue of economic access. The estimated prevalence of those who are income poor and have poor food consumption increased from 14% in 2009 to 17.2% in 2011.

HIECS data suggest that 35% of Egyptians suffer from poor dietary diversity and a further 56% are borderline in terms of dietary diversity. There is a strong correlation between poverty and poor dietary diversity, with 56.2% of the population in rural Upper Egypt, Egypt's poorest region, having a poor dietary diversity score and only 1.9% having a highly diverse diet.

Child malnutrition has reached very high levels. Chronic malnutrition among children started to rise as early as 2003, and by 2008 about one-third of Egyptian children under the age of five were stunted. Child malnutrition has since remained high despite improved economic levels, indicating the absence of a link between nutrition and economic growth, and a limited capacity of the health system to adequately detect, treat and monitor malnutrition, especially in children under age five (Breisinger et al. 2012).

Figure 2. Key food security and development indicators, 2005–2012.



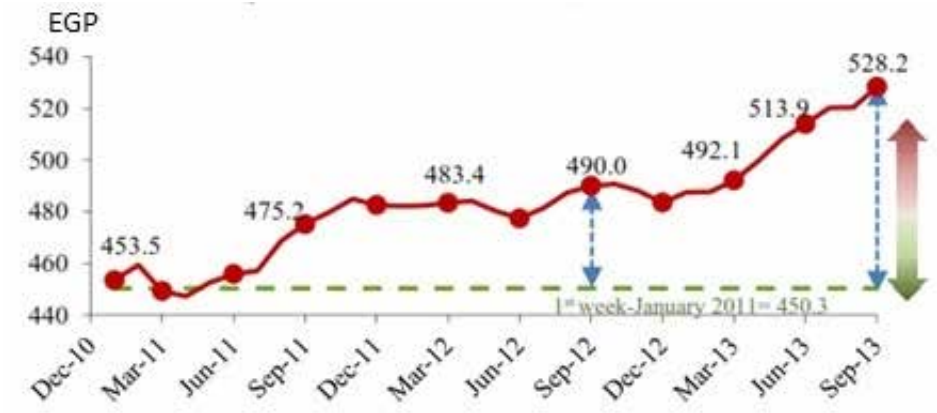
Source: Joint IFPRI–WFP Country Policy Note, May 2013.

Food basket price changes

The quarterly price burden (Figure 3), which indicates price changes in the food basket, showed continuous increases in the cost of an average food basket, denoted by the quarterly price burden in Quarter 3 (Q3) of 2013, which increased by 2.8% between June and September that year, compared to 4.4% increase in Q2 (March to June 2013). Between January 2011 and September 2013, the food basket price increased by 17.3%, resulting in a nominal price increase of EGP 77.9/basket (personal communication with Egyptian Food Observation, September 2013).

In response to food price increases, households have tended to adopt rationing strategies and dietary change—buying cheaper food commodities and reducing consumption of different food types, with adverse implications for dietary diversity as reliance on cheap calorie-dense foods is heightened (IFPRI–WFP 2013).

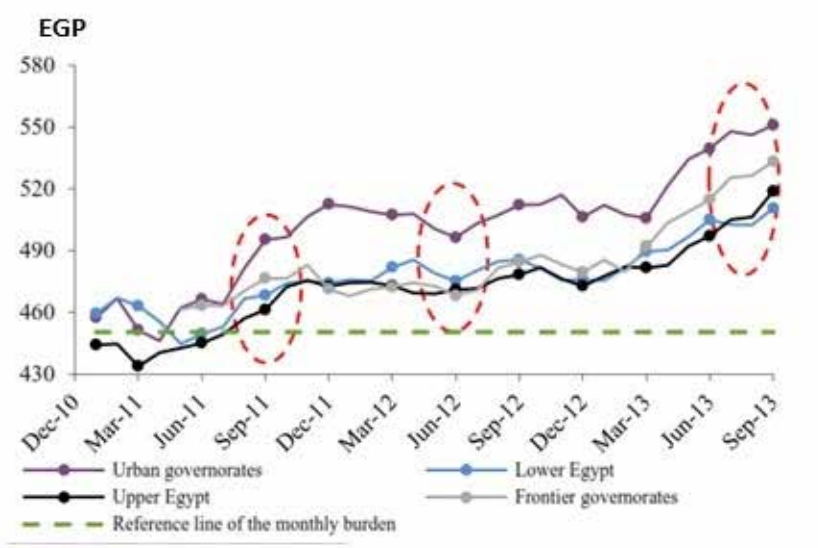
Figure 3. Quarterly price burden, Dec 2010–Sept 2013.



Source: Egyptian Food Observatory, Food Monitoring and Evaluation System Quarterly Bulletin 13, Sept 2013.

Prices rose across all regions (Figure 4), with Upper Egypt seeing the largest increase of 4.4% between June and September 2013, followed by frontier governorates (3.6%), urban governorates (2.1%) and Lower Egypt (1.1%). Despite continued price increase during Q3 of 2013, the relative slowdown of such price hikes is worth noticing. Such an increase is reflected in slowing down the rate of increase in the cost of the average food basket compared to the rates of increase witnessed in the previous quarter.

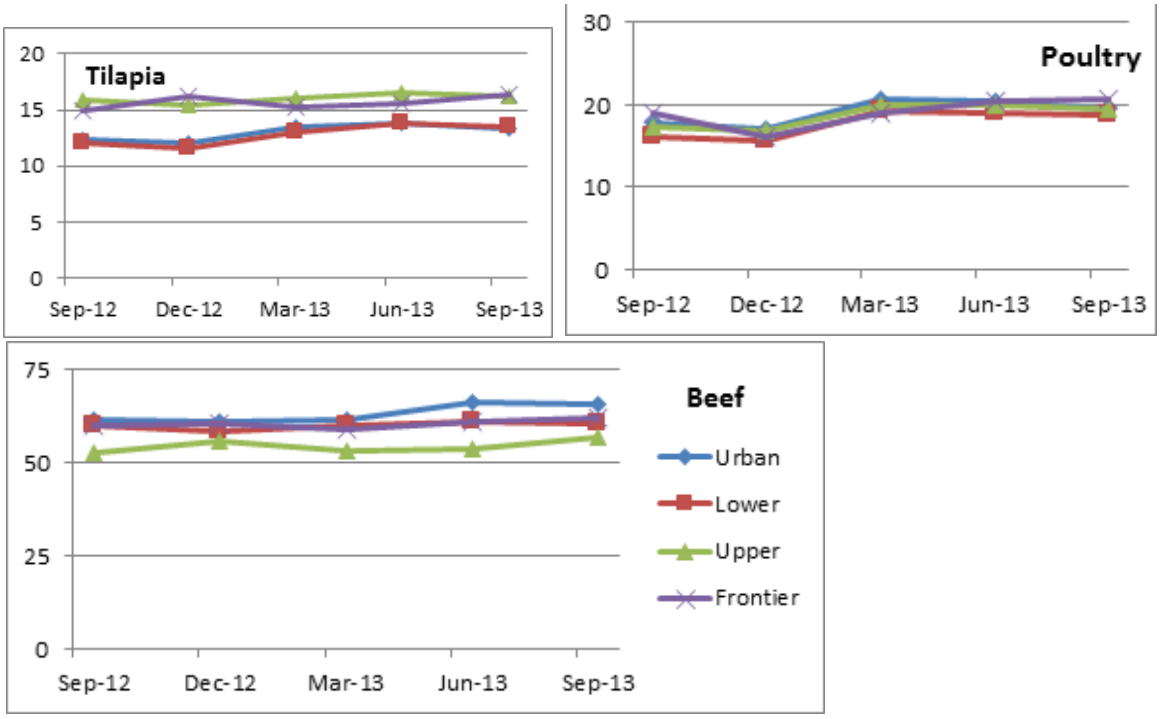
Figure 4. Quarterly price burden by region, Dec 2010–Sept 2013.



Source: Egyptian Food Observatory, Food Monitoring and Evaluation System Quarterly Bulletin 13, Sept 2013.

The price of beef, poultry and tilapia varied across regions, the lowest beef price being recorded in the Upper Egypt governorates and the highest price in the urban governorates. Lowest poultry prices were apparent in the Lower Egypt governorates and the highest price in the frontier governorates. The tilapia price was highest in the Upper Egypt governorates and frontier governorates due to the absence of or remoteness to production sites, and was lowest in Urban Egypt and Lower Egypt governorates where access to fish farmed fish supplies is better. The price differences may be related to distance to production sites and food consumption patterns as frontier governorates usually consume more fish than people in other locations (Figure 5). There are no available data on patterns of change in food consumption during this period.

Figure 5. Quarterly tilapia, poultry and beef prices by region, 2012–2013.

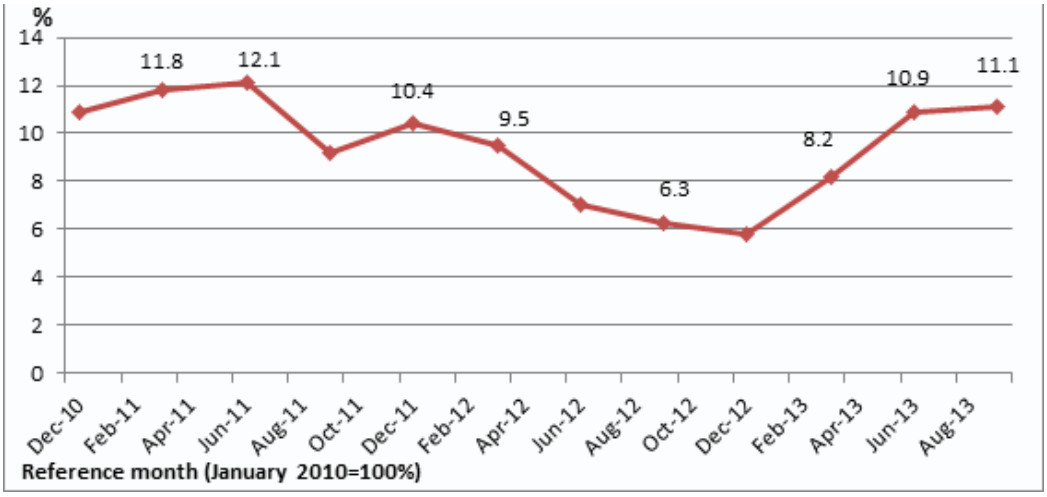


Source: Author calculations from Egyptian Food Observatory Quarterly Bulletin 9 and 10 in 2012; 11, 12 and 13 in 2013.

Inflation rates

Inflation, as measured by consumer price inflation (CPI) increased by 11.1% in September 2013 year-on-year (compared to September 2012) and 1.7% month-on-month against 6.3% and 1.5% in the same period the previous year (Figure 6).

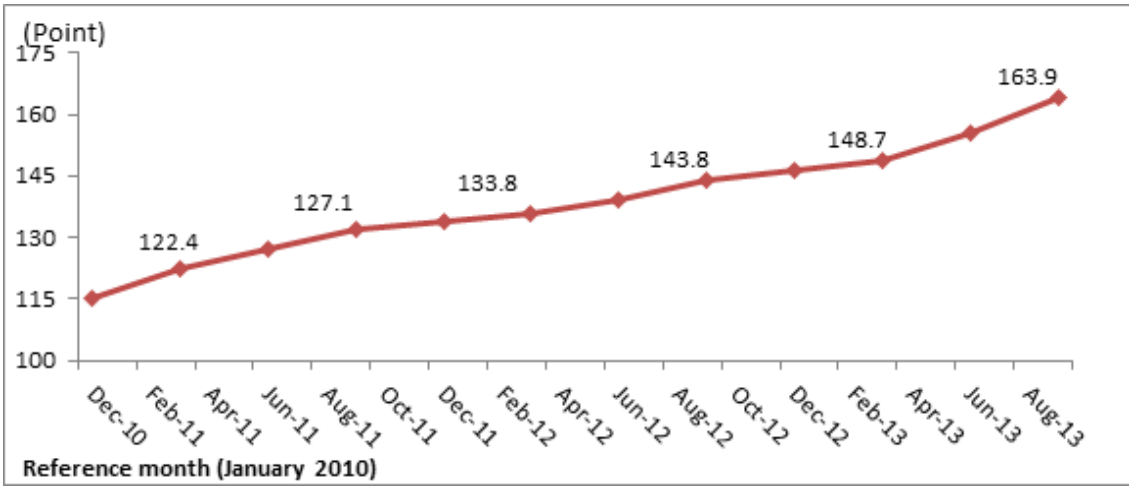
Figure 6. Quarterly inflation rate for consumer prices, Dec 2010–Sept 2013.



Source: Egyptian Food Observatory, Food Monitoring and Evaluation System Quarterly Bulletin 13, Sept 2013.

The food and beverages price index saw a sizeable increase of 14% in September 2013 year-on-year and 2.1% month-on-month against 9.1% annually and 2.1% monthly in 2012 (Figure 7). The vegetable price increased by 3.6% monthly and 6.8% annually; while bread and cereals price increased by 0.9% monthly and 19.6% annually. While the prices of fish and seafood increased by 19.9%, meat and poultry increased by 18.9% during September 2012–2013 (CAPMAS 2013).

Figure 7. Food and beverages price index, Dec 2010–Sept 2013.



Source: Egyptian Food Observatory, Food Monitoring and Evaluation System Quarterly Bulletin 13, Sept 2013.

Current policy issues under debate

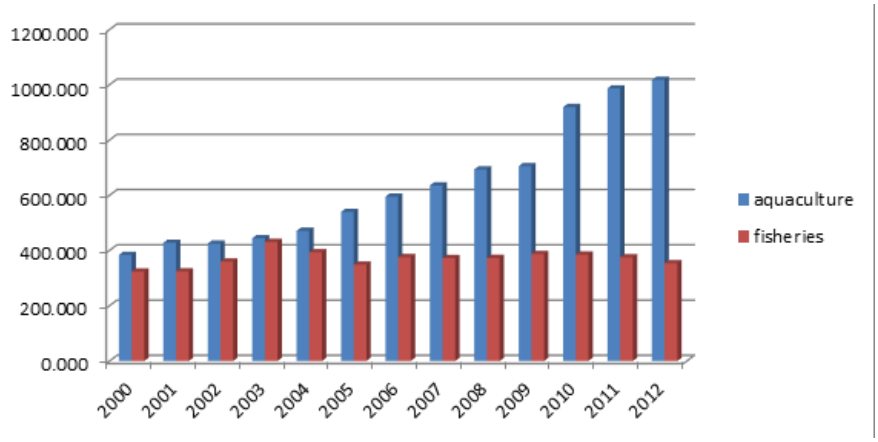
Different stakeholders associated with food policy in Egypt have shaped the political economy context. The key players in this field have been government institutions, particularly the Ministry of Social Solidarity. However, there are other government institutions whose mandates overlap with that of the Ministry of Social Solidarity with regard to the setting and implementation of food policy. These include: the Ministry of Agriculture and Land Reclamation, the Ministry of Trade and Industry, the Ministry of Irrigation and Water Resources, the Ministry of Health and the Ministry of Finance. The interaction between such ministries, their level of coordination, and their political influence have played a paramount role in formulating and implementing food policy, particularly during times of food crisis.

Stakeholders dealing with food policy include: public companies, cooperatives and export commodity councils. Other stakeholders associated with food policy are many think tanks and research institutions (Handoussa et al. 2009) including the Egyptian Food Security Information Center, which was established in 2007 with the support of FAO and WFP, and is affiliated with the Ministry of Agriculture and Land Reclamation. The coordination committee of the Food Safety Information Center consists of representatives from several related ministries and agencies. Relevant donors are invited on a regular basis to the meetings of the coordination committee of the centre. Also among the important research bodies dealing with food security is the Information and Decision Support Centre of the Cabinet (IDSC). IDSC established the Egyptian Food Observatory, which provides tools for monitoring and evaluating the situation for a list of agricultural crops and main food commodities. In addition, it develops early-warning tools that anticipate future food crises whether they are triggered domestically or internationally (Ghoneim 2012).

Production

The main sources of fish production in Egypt are: marine fisheries, inland fisheries in lakes, lagoons, Nile River, irrigation and drainage canals and aquaculture. Between 2000 and 2012, total fish production increased from 724,410 to 1,371,975 t, an increase of 89.4% (GAFRD 2014). This was mainly due to increased production from aquaculture, which rose by 165% to 1,017,738 t over this period, while other sources showed either modest increases or declines. In 2012, aquaculture production represented 74.2% of total fisheries and aquaculture production (Figure 8) by volume and 69.3% by value (GAFRD 2014). The most widely cultured fish species in Egypt is Nile tilapia followed by mullet and carp. Based on 2012 GAFRD statistics, tilapia, carp, and mullet accounted for 75.5, 6.6 and 12.7% of aquaculture production (GAFRD 2014) while tilapia (28.8%), catfish (9.9%), mullet (9.5%), carp (4.5%), sardines (4.5%) and shrimps (3.3%) were the main capture fishery species.

Figure 8. Aquaculture and fisheries production in Egypt, 2000–2012.



Source: GAFRD (2014).

The main fish-farming system is earth ponds supplied by water from irrigation drainage canals. According to official statistics, in 2012, ponds were estimated to produce 71.73% of total aquaculture production compared to 24.5% for cages, 3.39% for rice fields and 0.24% for intensive systems such as concrete tanks (Table 8). Most ponds are farmed using semi-intensive methods either as monocultures of Nile tilapia or polycultures of tilapia and mullet or tilapia and carp.

Table 8. Volume of fish produced in various production systems, 2012

	Ownership/managed by			
Production system	State-owned	Privately owned	Total fish production (t)	% of total production
Earthen ponds	9509	720,412	729,921	71.73
Cages	–	249,385	249,385	24.5
Tanks (intensive)	–	2444	2444	0.24
Semi-intensive	–	1451	1451	0.14
Fish in rice field	–	34,537	34,537	3.39
Grand Total	9509	1,008,229	1,017,738	100.00

Source: GAFRD (2014).

According to GAFRD figures, the total fishpond culture area decreased from 140,826 ha in 2006 to 119,821 ha in 2012. Most fish farms are privately operated but they may be established on land leased from GAFRD, land leased from other landowners such as the local authority or on privately owned land (Table 9). The data obtained from a recent survey (Macfadyen et al. 2011) indicated that 55% of the surveyed fish farm operators operate a fish farm 8.4 ha or less in size, 25% have 8.4 to 16.8 ha, 8.3% have 16.8 to 25.2 ha, 5% have 25.2 to 33.6 ha and 6.7% have a fish farm size larger than 33.6 ha. There are also nine government fish farms with areas from 420 to 840 ha.

Table 9. Total private and governmental farm area (in ha), 2006–2012

Ownership	2006	2007	2008	2009	2010	2011	2012
Private farm size (ha)	133,755.7	144,256.6	143,495.5	144,309.1	85,950.4	114,648.8	113,581
Government farm size (ha)	7071.5	7061.9	7440.3	7447.9	4717.3	5403.5	5970
Total (ha)	140,827.2	151,318.4	150,935.8	151,756.9	128,748.2	120,052.2	119,821

Source: GAFRD (2007–2012).

There are strict rules (overseen by GAFRD) regulating where fresh and brackish water fish farms can be built. They must be on land that is unsuitable for agriculture, so they should not be in traditionally irrigated areas where crops and vegetables are grown. Also, they must use water either from irrigation drainage canals or from drainage lakes such as Lakes Manzala, Lake Burullus or Lake Quaron. This means that fish farms tend to be concentrated in specific areas close to lakes. The exceptions to this are government farms and research facilities, such as the CLAR/WorldFish site in Abbassa where they are allowed to use water directly from irrigation canals, 'desert farms' where groundwater is used for fish farming, unlicensed fish farms in agricultural zones where the operators ignore the rules and cage-based fish farms in the lower reaches of the Nile, which are operating in contravention of GAFRD and Ministry of Irrigation rules. There are also pond-based marine fish farms along the Mediterranean coast and a few cage-based fish farms in saline lakes.

The fish-farming sector generates direct employment at a rate of 8.3 jobs (FTE) for each 100 t of fish produced/year (Table 10). Almost all the employees are male and around 50% are youth (below 30 years old). Most of the work is full-time; however, there is also part-time or seasonal employment such as stocking and harvesting or weed clearance. This suggests that total employment in Egyptian aquaculture production is around 78,000 FTE. Wages paid to those working in the sector are typically around USD 155 (EGP 800) per month for full-time labour and USD 6 (EGP 40) per day for part-time and seasonal labour. The average operational profit per tonne was estimated at USD 428 (EGP 2997) (Macfadyen et al. 2011).

Table 10. Operational data for the fish-farming subsector

Operational data	Kafr el Sheikh	Behera	Fayoum	Sharkia	Overall
Total fed of interviewed farms under production	531	448	198	341	1517
Average years involved in the sector	20	8	16	18	18
Average area under production (fed)	25	4	12	38	26
Average size of tilapia when stocking (g)	10	4	11	10	9.05
Average FTE per fed	0.21	0.23	0.38	0.23	0.26
Average FTE per 100 t	6.99	5.31	12.59	7.98	8.31
Average production (t/fed)	3.26	4.81	3.16	3.12	3.55
Average FCR	1.89	1.44	1.71	1.38	1.66
Average sales price (EGP/kg (all species))	9.70	8.26	11.79	9.87	9.98
Average sales price tilapia 'super' (EGP/kg)	9.59	8.75	11.88	9.34	10.14
Average percent of total production from tilapia (%)	86	94	93	79	89
Average stocking density tilapia/fed	12,786	17,500	13,656	11,012	13,790
Average stocking density mullet M. Cep/fed	700	784	858	788	776
Average stocking density mullet M. Cap/fed	1600	1354	1466	2167	1676
Average stocking density catfish/fed	200	317	n/a	844	332
Average growth period (months)	9.6	8.7	8.3	7.7	8.7
Average size tilapia at harvest (g)	276	235	283	252	265
Average size mullet M. Cep at harvest (g)	421	342	453	402	409
Average size mullet M. Cap at harvest (g)	223	206	50	177	216
Average size catfish at harvest (g)	1321	1333	n/a	1340	1481

Source: Macfadyen et al. (2011).

Harvested farmed fish are sold 'as is', mostly either fresh on ice (in summer months or if sales are made far from farms) or fresh with no ice (in winter months and/or if sales are made close to farms), or live (as with some tilapia). Post-harvest losses are estimated to be less than 1%. The recent value chain report suggests a number of reasons for poor performance of the sector including: poor quality of fish fry; poor quality of water; poor practices with regard to feed management, farm design and construction, fish health management, and stocking densities; consumer preference for wild fish and a distrust of processed products; and poor fish hygiene and handling practices throughout the value chain (Macfadyen et al. 2011).

Fry and fingerling production

Most of the country's fry and fingerling requirements are provided by privately owned hatcheries. There are 168 licensed hatcheries, three of which are for marine species, and about 500 unlicensed private hatcheries (GAFRD 2014). Seed production from private hatcheries is dominated by tilapia (95.24%) followed by shrimp (2.84%), sea bream (1.00%), seabass (0.90%) and common sole (0.12%). Most of the hatcheries are in the leading governorates for aquaculture production, including Kafr el-Sheikh, which has 135 licensed hatcheries, Fayoum with 12 licensed hatcheries and Beheira with five licensed hatcheries. There are 12 governmental fish hatcheries, one of which (Suez Canal University) is dedicated to research. Table 11 shows the number of freshwater licensed private hatcheries, location, area and production as of 2011.

Table 11. Location, number of tilapia private hatcheries, area and production, 2012

Governorate	No. of hatcheries	Area (feddan)	Seeds production (million fry)
Beheira	5	13	5
Kafer El-Sheikh	135	685	130
Qalubia	1	1	2
Daqahlia	1	1	2
Ismalia	4	10	4
Giza	4	18	5
Fayoum	12	13	12
Sohag	1	5	1
Aswan	2	15	30
Total	165	761	191

Source: GAFRD (2012).

Fingerling production levels and composition for government and private hatcheries between 2008 and 2012 are shown in Table 12. Red tilapia, common, silver and grass carps are produced by governmental fish farms, while shrimp and common sole are produced by private hatcheries. Sea bream, seabass, and tilapia are produced by both private and government hatcheries; the production levels of these species in private hatcheries are higher than that in the government hatcheries. In 2011, licensed private and government hatcheries produced 200.55 and 209.592 million fingerlings, respectively.

Table 12. Government and private fish hatcheries fingerling production (in million pieces), 2008–2012

Species	Governmental hatcheries					Private hatcheries				
	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Sea bream	0.25	0.25	0.25	0.25	0.25	2.00	0.49	2.00	2.00	2.000
Seabass	0.26	0.25	0.26		0.196	1.60	3.16	1.60	1.60	1.600
Shrimp	N/A	N/A	N/A	N/A	N/A	9.70	20.15	9.70	9.70	5.700
Red tilapia	0.50	1.05	1.00	2.00	N/A	N/A	N/A	N/A	N/A	N/A
Tilapia	22.60	29.18	41.09	71.02	51.558	119.00	64.00	169.0	174.0	191.0
Sole	N/A	N/A	N/A	N/A	N/A	0.25	0.05	0.25	0.25	0.25
Com. carp	126.20	123.77	114.96	111.13	89.200	N/A	N/A	N/A	N/A	N/A
Grass carp	57.77	56.01	47.48	77.82	44.226	N/A	N/A	N/A	N/A	N/A
Silver carp	6.90	6.43	12.53	24.01	23.608	N/A	N/A	N/A	N/A	N/A
Total	214.49	216.94	217.57	286.24	209.592	132.55	87.85	182.5	187.5	200.5

Source: GAFRD (2009–2014).

There is also a significant fishery for wild mullet seabass and sea bream seed. GAFRD is responsible for the capture and distribution of wild fry, and uses a number of fishermen to catch and collect the fry in seven fry collection centres. The fry are used to stock governmental fish farms and for sale to registered private farms (GAFRD 2014). However, most of the mullet fry supplied to fresh and brackish water fish farms comes from unlicensed fry catchers who sell their fry through traders to the farms.

Policies in place that influence production

The Ministry of Agriculture and Land Reclamation (MOALR) is responsible for managing the fisheries and aquaculture sector. In 1983 the General Authority for Fishery Resources Development (GAFRD) was formed by Presidential Decree 90/183 as the body responsible for the sector and its powers and duties were assigned (FAO 2011a). Act No. 124 of 1983 on Fishing, Aquatic Life and Aquaculture is the main body of fisheries legislation for the sector. The most important articles in the act regarding aquaculture are outlined below.

1. It is prohibited to import foreign fish, fry or eggs except with permission from GAFRD after technical consultation with Institute of Fisheries and Oceanography (Article 17).
2. It is prohibited to catch, transfer, or process fish fry from any water body except with permission from GAFRD (Article 19).
3. If the period of aquaculture lease is less than 5 years, then it may be authorized by the Minister of Agriculture and priority is given to public authorities, public sector companies and aquaculture cooperatives (Article 47).
4. It is prohibited to establish fish farms except in areas unsuitable for agriculture and water sources should be from lakes or drainage canals. Only governmental fish hatcheries can use freshwater. Fish farms have to have a permit from GAFRD and approval from Ministry of Irrigation (MOI) indicating water inlet, outlet and the amount of water to be used (Article 48).
5. Areas suitable for fish farming are designated by GAFRD (Article 49).
6. Except in water canals used for irrigation, drainage and drinking purposes, it is prohibited to clear, cut or spray weeds and aquatic plants specified by GAFRD in consultation with MOI (Article 50).

GAFRD leases the land it controls, within 200 m of shorelines, for aquaculture use through auction. Privately owned land can be issued with a permit from GAFRD after getting the approval of MOI to determine the quantity and source of water. Cages are prohibited in the Nile and in irrigation and drainage canals unless a permit is obtained from MOI. The land lease for aquaculture can extend for 5 years (one period) or for a number of periods not exceeding 25 years and the beneficiary is obliged to increase fish production by using new technologies (Minster of Agriculture Decree No. 1132, 2007).

In 2005, GAFRD developed a policy for the development of the fisheries and aquaculture sector in Egypt until 2017. The overall aim of the policy is to increase the return on fish resources through environmentally compatible systems; reach annual production of 1.5 milliontonnes (an annual per capita local fish production amounting to 16.5 kg) by 2017 so as to maintain per capita of fish production given the growing population; improve fish products from various sources to be compatible with international requirements; and support marine aquaculture.

The policy has three major objectives, to:

1. ensure use of natural fisheries to achieve sustainability whilst exploring the possibility of using unexploited area and types
2. maximize revenues from aquaculture projects, especially water resources. This could be achieved through incentivizing private and cooperative sectors and implementing research projects that seek to maximize return in this sector

3. reform institutional structures for fish resources and build capacity. The structure and mandate of GAFRD needs to reviewed, particularly those related to control, regulation, enforcement of regulations, implementation of pilot and exploratory projects in the field of development, modernization and guidance.

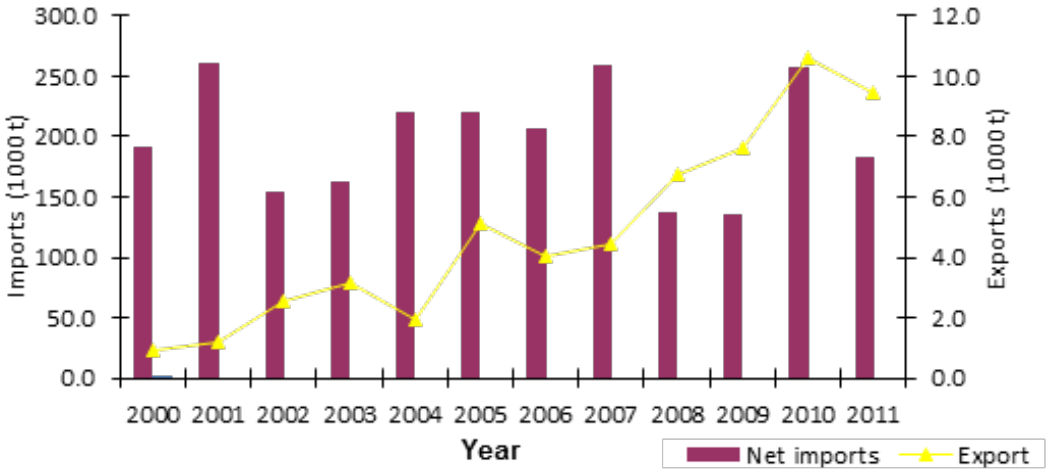
One of the key issues in the policy is that it proposes that GAFRD should desist from activities related to production, use of water surfaces and aquaculture, which should be undertaken by the private and cooperative sectors. The role of GAFRD would be limited to setting environmental, health, economic and social standards. In other words, it should assume the role of regulator rather than producer.

Imports and exports

Imports of fishery products by Egypt have been fairly constant over the last decade, at around 190,000 t per year, but there has been a rise in average import price, from USD 0.53 to USD 2.84/kg, resulted in import value rising from USD 101.5 million in 2000 to USD 430.2 million in 2012. In 2012, fish imports represented 2.79% of the import value of agriculture products and 0.58% of the total merchandise import value. The greatest quantity of imported fish and seafood (based on the average of the last three years 2010–2012) were whole frozen fish (76.02%) followed by frozen shrimps and prawn (11.28%) and frozen fish fillets (9.52%). In terms of value, these groups represented 67.97, 19.92, and 7.87% of fish import value, respectively. Whole frozen fish includes unidentified species of fish (58.08%); mackerel (27.11%); herring (7.03%); and sardines, brisling and sprats (5.95%).

Population increases between 2000 and 2012 mean that per capita imports have decreased by 0.59 kg (21%) while per capita import value increased by USD 4.83. Egypt exports relatively small amounts of fish. The trends in Egypt's fish exports in terms of quantity are shown in Figure 9. In 2000, exports of fishery products only amounted to 920 t valued at USD 1.12 million. By 2012, that had risen to 2960 t valued at USD 18.24 million. The average export price has increased from USD 1.2/kg in 2000 to USD 6.1/kg in 2012. Over the same period, fish exports represented 0.33 and 0.04% of agriculture products export value and total merchandise export value, respectively. The most exported products, based on 2010–2012 average, are whole fresh or chilled fish (86.04% in quantity and 75.29% in value), followed by octopus (7.27% in quantity and 17.7% in value).

Figure 9. Imports and exports of fish for Egypt, 2000–2011.



Source: CAPMAS and GAFRD.

Egypt's trade balance for fish and fishery products in terms of quantity and value is heavily skewed towards imports (Figure 9). Between 2000 and 2012, the fish and fishery products net trade balance (imports–exports) decreased slightly from 189,760 to 183,970 t while the value increased from USD 100.37 million to USD 513.45 million.

Inputs and services: Fish health

The MoALR has overall responsibility for managing animal and fish health through the General Organization for Veterinary Services (GOVS) and Animal Health Research Institute (AHRI). GOVS was set up by Presidential Decree No. 187/1984 with the aim of protecting livestock and human health against infectious and epidemic diseases. The mandate of AHRI, which is a member of Agriculture Research Center, includes animal health and safety of animal origin foods. It is responsible for the confirmation and official reporting of test results to GOVS. CAPMAS issues morbidity and disease reports for livestock and poultry but not for fish.

At present the role of the private sector in fish health is limited. There are a few businesses importing fish health products including probiotics, immunostimulants, disinfectants and chemicals to treat fish disease. Some small shops owned by veterinarians provide prescriptions. There are a few consultancy offices that provide advice to farmers on aquaculture practices, including disease problems.

Fish diseases can be classified as bacterial, parasitic, fungal or viral. In semi-intensive, pond-based fish farms, most fish disease problems can be traced back to husbandry issues such as: low oxygen levels, poor quality feeds, overfeeding, and low or fluctuating water temperatures. The disease-causing organisms are present in the water supply or near to wild fish populations but only become problematic when the farmed fish are exposed to stress. The occurrence and severity of fish disease outbreaks is usually worse in more intensive farms and at more vulnerable stages in the fish growing cycle, such as in hatcheries. Fortunately, most Egyptian fish farms operate low-intensity systems so significant disease outbreaks are infrequent.

There were reports of disease outbreaks during the summer of 2013, which are currently under investigation. However, they may be associated with water supply problems caused by diesel shortages in May/June 2013. Aly (2013) reported on the incidence of fish diseases in freshwater fish farms between 2000 and 2012 (Table 13). In addition, a survey was carried out by WorldFish staff (unpublished data: 2011–2012) to explore fish producers' strategies for fish health management in Kafr el-Sheikh, Behera and Sharkia governorates (Aly 2013). Disease outbreaks were reported as a problem in all three governorates. *Saprolegnia* was reported at two farms; *Aeromonas* infection was reported at three farms and treatments were applied (salt treatment for *Saprolegnia* and oxytetracyclin for *Aeromonas*). Of 14 farms in Sharkia that were investigated, *Saprolegnia* was detected in two farms and two types of treatments were applied (potassium permanganate and antibiotics). In Kafr el-Sheikh, of the 34 farms surveyed, *Saprolegnia* was detected on seven farms. Two farms were also infected with *Aeromonas*, and during the infection period two treatments were applied (antifungal anticide and ciprofloxacin) (Aly 2013). The survey suggested that while some farmers seek fish health advice from universities, research institutes, veterinarians and consultants, others go directly to dispensaries or ask respected neighbouring farmers for advice.

GOVS is the competent authority nominated by the government for certification of food safety conditions for export of fishery products to the EU. The Fish Inspection Unit is the body in the organization responsible for supervising, revising and enforcing conditions and procedures for exporting fish and marine products, and coordinates with the Central Administration of Veterinary Quarantine and Inspections. It is responsible for implementing the Joint Ministerial Decree No (1909/2001) regarding Regulations and Procedures Related to Fish and Marine Products Exports to European Union Countries. While several processing establishments are entitled to export capture fish to the EU, the process to enable farmed fish exports has not yet been initiated by GOVS.

Table 13. Common bacterial and parasitic infections among freshwater fish, 2000–2012

Year	Bacterial pathogen/parasite	Fish species affected	Site
2000	*Aeromonashydrophila, Flavobacteriumcolumnare, Vibroanguillarum*	Nile tilapia, mullet sp., *Clarias*catfish	Dakahila, Sharkia
2000	*Encysted metacercariae*	Nile tilapia	Sharkia, Dakahlia
2001	*Trypanosome, Encysted metacercariae, monogenea, ectoparasites*	African catfish, *Morymyruskanumme*, *Bagrusbajad* and Nile tilapia	
2001	*F. columnare, Pseudomonas fluorescens, Yersinia ruckeri*	Nile tilapia, *Clarias*catfish, carp, goldfish *(C. auratu)* and common carp	Abbassa
2002	Ectoparasites, metacercariae	African catfish, Nile tilapia	Dakahlia
2002	*Pseudomonas fluorescens, Streptococcus iniae*	Oreochromisniloticus	Ismailia, Sharkia, Fayoum
2003	*Ectoparasites, monogenea, helminthes*	Freshwater fishes	
2003	*Klebsiella pneumonia, Enterococcus faecalis*	Nile tilapia	Kafr el-Sheikh
2004	Ectoparasites	Nile tilapia, blue tilapia, *Tilapia zillii*, African catfish and common carp	Sharkia, Dakahlia
2004	*Pseudomonas fluorescens, P. aureginosa, P. anguilliseptica, P. pseudoalkaligenes*	Nile tilapia, African catfish, silver carp and grey mullet	Kafr el-Sheikh
2005	*Yersinia ruckeri*	Nile tilapia, common carp and monosex tilapia	Behera and Kafr el-Sheikh
2006	*Edwardsiellatarda, E. Ictaluri, Streptococcus faecelis, A. hydrophila*and *P. fluorescens*	Nile tilapia, common carp, African catfish and grey mullet	Behera, Kafr el-Sheikh and Alexandria
2006	Metacercariae, fluke trematodes and Cestodes	African catfish	Ismailia
2007	Ectoparasites	*Oreochromis*spp, *Clariaslazera,* silver carp, black carp and common carp	Behera, Sharkia
2008	*Cleidodiscusaculeatus*	Common carp	Sharkia
2009	*Trichodinamutabilis, Chilodonellahexasticha, (Gyrodactylusrysavyi)*	Nile tilapia	Giza
2010	*Pseudomonas aerogenosa*	Nile tilapia	Alexandria
2011	*Cichlidogyrustilapiae, Cichlidogyrusaegypticus, Cichlidogyruscirratus, Quadricanthusaegypticus, Macrogyrodactylusclarii, Trichodinacentrostrigeata, Trichodinarectinucinata, Chillodinellahexastica, Ichthyophthiriusmultifillis, Henneuguyabranchialis, Lamproglena monody*	*Oreochromisniloticus*and*Clariasgariepinus*	Kafr el-Sheikh
2012	*Polyonchobothriumclarias*and*Monobothriasp*	African catfish	Kafr el-Sheikh

Source: Aly (2013).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Inputs and services: Fish breeding and genetics

The main farmed fish species in fresh and brackish water ponds are Nile tilapia (*Oreochromisniloticus*), flathead grey mullet (*Mugilcephalus*) and thinlip mullet (Liza *ramada*). Small amounts of African catfish are also produced, mainly as a bycatch and various carp species are produced mainly on government farms.

Nile tilapia seed (fry and fingerlings) is produced by 400–500 private hatcheries, but only 150 of these are licensed by GAFRD. The hatcheries are located in the main farming governorates, particularly Kafr el-Sheikh, Behera, Sharkia and Port Said. Almost all tilapia hatcheries are producing sex-reversed fingerlings. There was a ban by MOALR on the use of methyl testosterone for sex reversal in Egypt, but this was lifted in 2010. While there have been attempts to develop the genetic potential of Egyptian Nile tilapia through selective breeding, and many private hatcheries claim to have developed faster growing strains, farmers often buy seed based on price rather than any guarantee of quality. WorldFish initiated a family-based selection program for Nile tilapia at the Abbassa research centre in the late 1990s, which has now been operating for 12 generations. Generation 9, which in on-station trials has the potential to grow at least 28% faster than the usual Egyptian commercial strains, is in the process of being released to fish farmers under the IEIDEAS project (Ibrahim et al. 2012).

Supplies of mullet fry and fingerlings to fish farms should fall under the control of GAFRD. In times of short supply, GAFRD first satisfies demand for its government farms, then sells the rest at the official price to registered (licensed) private fish farms. However, in practice, there are many private mullet fry catchers operating illegally along the Mediterranean coastline who supply fry to traders who then supply mullet fry and fingerlings to farmers. Unregistered fish farms must depend on this black market source to obtain mullet fry at elevated prices. As mullet fry are caught from the wild, there is no potential for genetic improvement or even control over which species is supplied. A few mullet hatcheries have been established. However, they have struggled because of high costs and low production rates, producing fry that are too costly to compete against wild-caught fry.

The major actors in fish genetics and breeding research include: WorldFish, CLAR (MOALR), Institute of Oceanography and Fisheries (Ministry of Scientific Research), Genetic Engineering Research Institute (Monufiya University), and departments in agriculture and veterinary colleges in Egyptian universities (Kafr el-Sheikh, Suez).

Research on fish breeding and genetics in Egypt has a relatively short history (El-Ghobashy 2001). Research has been carried out on strain evaluation, biochemical identification and DNA fingerprinting. However, CLAR participated with INGA in a project for the genetic enhancement of Egyptian farmed tilapia under different environmental and culture conditions with the objective of using the data to establish an effective breeding program. The above research program had no significant direct impact on farmers as it did not have any mechanism for dissemination.

Inputs and services: Feeds

In 1999, there were five feed mills (two government and three private) producing around 20,000 t/year. By 2004, the number of fish feed mills had increased to 18 mills with a production level of 250,000 t/year (El-Sayed 2007). More recently it has been estimated that there are at least 60 fish feed mills producing between 800,000 and 1,000,000 t/year (El-Sayed 2014).

The process for producing extruded fish feed was introduced into Egypt in the mid-1990s (El-Sayed 2007). Currently there are 5 mills producing extruded fish feed, representing 20–25% of total fish feed production. Feed mills also provide a wide range of different feed formulations to match the requirements of different stages of the growth cycle (e.g. different protein content). In addition to the registered mills, there are around 50 small-scale pelletizing units, each producing 3000–4000 t/year and with total annual production of 120,000 to 240,000 t (El-Naggar et al. 2011). These pelletizing units use simple technology and may not be equipped with air driers. They offer the service of compressing farmers' feed ingredients for about EGP 100–150/t (El-Naggar et al. 2011). Formulated fish feed (25% crude protein) now costs as much as USD 680 (EGP 4800/t), up from around USD 310 (EGP 1250) in 2001. The MoALR is responsible for issuing feed mill permits and is responsible for monitoring both the feed ingredients and the final product. However, this monitoring is reported to be insufficient and not systematic.

Most of the fish feed ingredients are imported from abroad and prices have been rising. World prices of fish meal, corn and soybean for the period from 2000 to 2012 are shown in Table 14. The highest price rise per year was attained by fish meal (11.8%), followed by corn (10.5%), US soybean (9.4%) and Hamburg soybean (8.4%). Table 14 also shows Egyptian imports of fish meal, corn and soybean in terms of volumes and values for the period from 2000 to 2012. Between 2000 and 2012, annual imports of soya increased by 746,000 t (307%) while corn import volumes rose by 2.3 million tonnes (49.6%). Over the same period, the quantity of imported fish meal decreased by 45,000 t (84.3%). Import price per tonne (USD) increased by 102% for soybean, by 169% for corn and by 108% for fish meal. The decreasing value of the Egyptian currency has led to an increase in feed prices by up to 30% in the last three years.

Table 14. Egypt imports of major fish feed ingredients and average prices, 2000–2012

	Fish meal			Corn			Soybean		
Year	Volume (000 tonnes)	Value (million USD)	Price (USD/t)	Volume (000 tonnes)	Value (million (USD)	Price (USD/t)	Volume (000 tonnes)	Value (million (USD)	Price (USD/t)
2000	53.4	35.3	660.7	4710.0	541.6	115.0	242.7	52.8	217.7
2001	53.0	28.5	536.7	4797.2	553.1	115.3	349.9	79.3	226.5
2002	22.2	13.5	606.6	4720.6	591.6	125.3	322.0	71.3	221.4
2003	14.8	7.4	502.5	4052.6	528.8	130.5	332.0	89.0	268.1
2004	15.2	9.1	598.0	2429.3	364.8	150.2	214.9	64.5	300.2
2005	17.2	12.2	708.6	5095.0	696.2	136.6	574.0	193.9	337.8
2006	8.5	4.3	506.9	3769.4	545.3	144.7	572.9	163.3	285.1
2007	17.3	6.9	401.6	5263.1	1076.8	204.6	1136.2	427.6	376.4
2008	3.9	3.9	999.2	3980.0	1036.6	260.5	1192.4	450.0	377.4
2009	8.4	8.4	999.4	5416.3	947.8	175.0	548.7	660.3	1203.5
2010	23.9	8.6	358.1	6170.5	1271.5	206.1	1752.3	780.8	445.6
2011	7.2	7.4	1028.6	7047.9	2179.9	309.3	988.1	347.9	352.0
2012	8.4	11.5	1371.7	N/A	1958.5	N/A	989.0	435.5	440.3

Source: UN comtrade; FAOSTAT.

Fish feed costs represent about 68–87% of total variable costs of fishpond culture in Egypt, so the steady increase in feed price is a serious problem for fish farmers, impacting directly on profitability and the sustainability of the industry, especially with stagnant fish sale prices (Macfadyen et al. 2011; Hebicha et al. 2013). Between 2008 and 2012 the price of fish feed increased by 57% while tilapia prices increased by only 16–18% (Hebicha et al. 2013). A recent study has shown that a 1% increase in fish feed price would decrease the optimum feeding rate by 2.35%, and decrease stocking rate, production and profits by 1.37% (Hebicha et al. 2013). The increase in feed price will lead the producer to use less feed and fingerlings or to buy lower quality feed or purchase feed ingredients and make his own feed. The lower quality feed that may result in worsening FCRs and ultimately increase production costs per tonne of fish produced, even if farmers may have the impression that they are reducing costs.

With the exception of Fayoum Fish Farmers Association (FFFA), there is no effective group action by farmers to buy feed in bulk (with potential price savings on bulk orders) or to ensure they receive good quality product. Some lessons can be learnt from FFFA, which buys fish feed in bulk for its members and can get a guaranteed top quality product. The FFFA members pay for part of their feed costs up-front and then make a monthly payment. This reduces the need for farmers to obtain credit from feed traders, reducing the risk to farmers of being provided with poor quality feed.

Inputs and services: Knowledge systems

There are a large number of government research institutions and universities (e.g. Cairo, Ein Shams, Alexandria, Suez Canal, El Azhar, El Mansura, Tanta, Asuit, Zagazig and Upper Egypt) specializing in fisheries research and education subjects. Research usually focuses on applied needs aimed at improving production efficiency. Specific research topics are usually selected through close dialogue between research institutions, GAFRD, the Egyptian Aquaculture Society and the producers. Conferences, workshops and meetings are frequently held and producers are invited to discuss production problems with scientists. On-farm participation in research is common in government-run facilities and in private enterprises. Research results are usually published in scientific journals, but simplified articles can be published in magazines and other publications produced by local aquaculture societies, which are easily accessible to farmers, experts and technicians.

The GAFRD extension and training directorates are in charge of transferring information to farmers with a lesser degree of education by publishing simple extension papers. Free aquaculture training courses are also organized and delivered by GAFRD.

WorldFish has had a fisheries and aquaculture research program in Egypt since 1998, and has been a major player in helping aquaculture to grow and become the main source of fish for Egyptian consumers. Over the past 15 years, 830 trainees from different governorates in the country have attended training courses at the WorldFish research centre in Abbassa. The WorldFish-managed IEIDEAS project has delivered field-based best management practice training to 1650 farmers since October 2012 and aims to train 3000 fish farmers by December 2014.

Inputs and services: Credit

There are 40 banks registered with the Central Bank of Egypt (CBE), among which five are state-owned banks. The rest of the banks include private-sector banks owned by regional and international foreign banks and some private sector banks in which the government holds ownership stakes. As of May 2013, the monthly average interest rate on loans (corporate for one year or less) and deposits (six months to a year) is 12.5 and 9.3%, respectively (CBE). In theory, bank loans are available to farmers who own a licensed fish farm. In practice, it is difficult for fish farmers to secure loans because of perceived risks.

The state-owned Principal Bank for Development and Agricultural Credit (PBDAC) was established as a specialized bank to grant loans to farmers. It provides services in all the governorates through its extensive network of branches all over the country. It is considered to be the largest specialized credit institution in Egypt. Loans are offered to cover investment (short-, medium- and long-term), running costs and consumer loans. The current deposits and outstanding loans, in June 2010, were EGP 28.5 billion (USD 4.9 billion) and EGP 13.9 billion (USD 2.4 billion), respectively (Naziri 2011). The bank accepts: land, real estate, agricultural machinery, crop yields that can be stored, deposits, or letters of guarantee as collateral for loans. According to CAPMAS (2013) the total amount of short- and medium-term loans granted by the bank in 2011/12 was EGP 5,334.54 million, among which EGP 3,375.50 million (63.28%) was allocated to animal production, EGP 4.80 million (0.89%) for poultry and EGP 1.90 million (0.04%) for the fisheries sector (both aquaculture or fishery projects).

Table 15. Short-term loans granted from bank of development agriculture credit for fish production, by governorate, 2011–2012

Governorate	Loan amount (EGP)	Total loan for fish production (%)
Ismailia	1,342,716	70.84
Kafr el Sheikh	515,000	27.17
Fayoum	22,200	1.17
Behera	15,000	0.79
Sharkia	395	0.02
Total loans for fish production	1,895,311	100.00

Source: Capmas (2013).

Lending to the private business sector represented 62% of total lending of the banking system. Agriculture sector loans, including aquaculture, represented 2.5% of total outstanding loans (Naziri 2011). Private and state-owned banks are reluctant to lend to the aquaculture sector because it is considered a high-risk business, and the lack of an aquaculture insurance market and adequate collateral, especially owned land, are also problematic. Most of the banks do not want to get involved with SMEs with relatively small loans (Naziri 2011). The majority (2011 official figure, 85.4%) of privately operated fishpond areas are rented from GAFRD that controls land within 200 m of shorelines (GAFRD 2012). It is entitled to offer land to be leased for aquaculture use through an auction system. Government policy discourages the sale of land. Aquaculture leases are usually granted for a limited period, which can be as short as 3 years but more usually 5 years, which can be renewed for multiple periods for up to 25 years. A condition of the lease is that the fish farmer is obligated to increase fish production by using new technologies (Minster of Agriculture Decree No. 1132, 2007). This is a relatively short time-scale and discourages investment by fish farmers, so many have campaigned for longer lease periods, of up to 25 years.

All fish farms, whether leased or owned by the operator should be licensed by GAFRD. In practice, many fish farms operate without a license due to the number of agencies that are involved and GAFRD rules about the layout of fish farms. Although fish farms are allowed to operate, even if they are not licensed, they will face restrictions in their ability to access services, such as official allocations of mullet fry, support from extension services and financial support through official channels.

Soft loans have been provided by the Multi Sector Support Program (MSSP), Agricultural Research and Development Fund (ARDF), and the Social Fund for Development (SFD) (Naziri 2011). The MSSP was a successful development program of Ministry of Agriculture funded by the European Commission between 1996 and 2004 (CIHEAM 2010; Naziri 2011). The overall objectives of MSSP were to increase income and employment in rural areas and to increase food production through the provision of financial and technical support to farmers and agricultural entrepreneurs in aquaculture, horticulture, poultry, farm irrigation and drainage development. Funds under the MSSP credit line were managed by the Commercial International Bank and eleven participating banks. The 546 projects financed by MSSP supported 22,247 beneficiaries and created about 15,000 jobs. Table 16 shows the numbers of loans, amount of loans, average size of loans and percentage of loans allocated to each sector. It is evident that the aquaculture sector had the lowest number of loans (84) representing only 15.38% of total number of loans. In addition, the average loan value allocated to the aquaculture sector was less than those for the poultry and horticulture sectors.

Table 16. Distribution of MSSP loans, 1997–2003

Sector	No. of loans	Amount (EGP)	Percentage	Mean loan size (EGP)
Aquaculture	84	28,169,000	8.65	335,345
Horticulture	156	104,666,244	32.13	670,937
Irrigation and drainage	182	51,419,803	15.79	282,526
Poultry	124	141,478,138	43.43	1,140,953
Total	546	325,733,185	100.00	596,581

Sources: CIHEAM(2010); Naziri(2011).

ARDF and SFD are still operating. ARDF interest rate charges are less than the commercial rates (7.5–9.5%). However, current credits offered to the aquaculture sector are less than 1.5% of the outstanding loans (Naziri 2011). SFD was founded by the government in 1991 as a social safety-net mechanism to mitigate the adverse effects of the Economic Reform and Structural Adjustment Program launched in the early 1990s. SFD has an outreach capacity through a network of 31 regional offices covering all governorates of Egypt. Its key roles include the creation of jobs through the development and support of MSEs by offering financial support and the economic and social empowerment of women. During 2012, SFD offered EGP 22.1 billion to 165,527 SME (SFD 2013). There are no exact figures about loans offered to the aquaculture sector but it is likely to be negligible.

While formal banking sector lending to the aquaculture sector is virtually nonexistent due to the high risks and absence of collateral if the farmer rents rather than owns the land, other actors of the chain are important sources of credit. A recent study (Macfadyen et al. 2011) shows that many fish farmers obtain credit either from feed mills/traders, and/or from fish traders/wholesalers in order to cover the cash-flow requirements of the business. With significant increases in feed costs since the mid-1990s, the reliance on such forms of finance by fish farmers, as opposed to their own finance, has become increasingly marked. Fish traders tend to make higher sales commission and more profit when lending to farms and collecting fish from the farm. The same may well be true for feed suppliers, with higher profits being made when such traders provide feed on credit. In some cases it may also result in suboptimal harvesting times, if fish farmers are pressured to repay finance at particular times by their creditors.

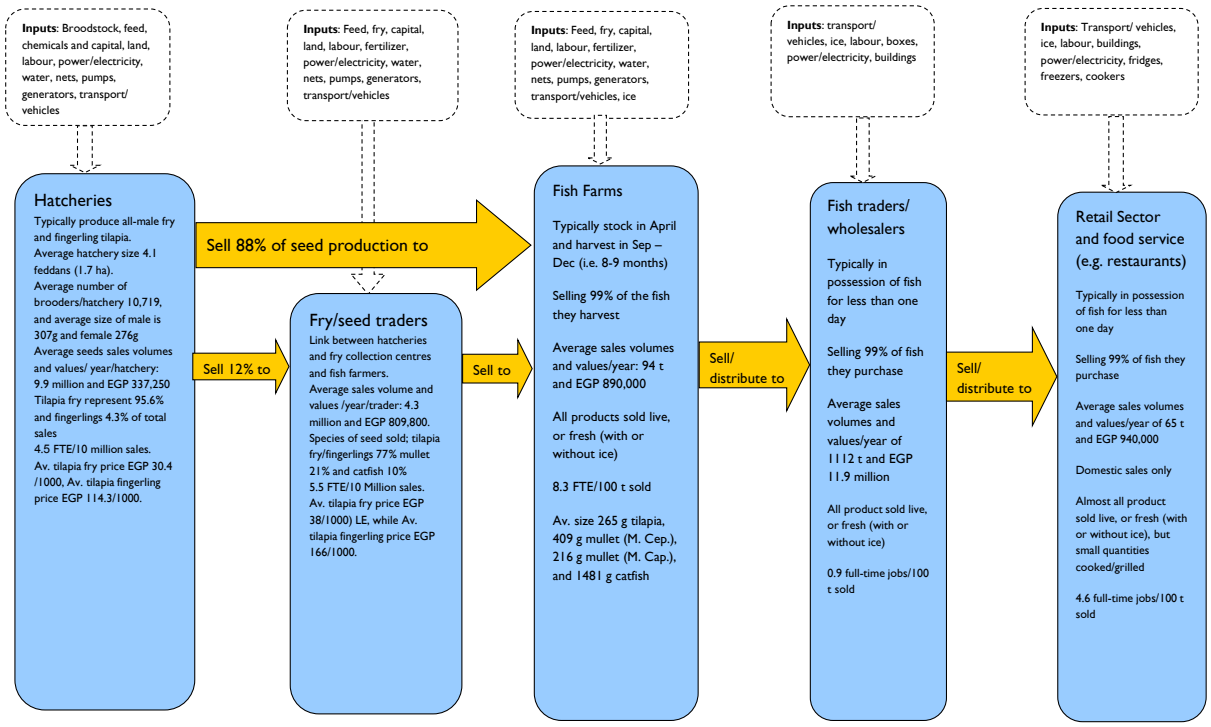

Dior

Value addition and marketing

There is virtually no processing or exports of farmed fish; therefore, the value chain is composed of hatcheries, fry/seed traders, fish farms, fish traders and wholesalers, retailers and consumers (Figure 10). Throughout the chain, fish are sold live, fresh with or without ice and prices depend on fish size. Farmers usually stock their ponds in April and harvest in September through to December to avoid fish losses due to cold weather in the winter season. This leads to an oversupply of fish and depressed prices through the harvesting season.

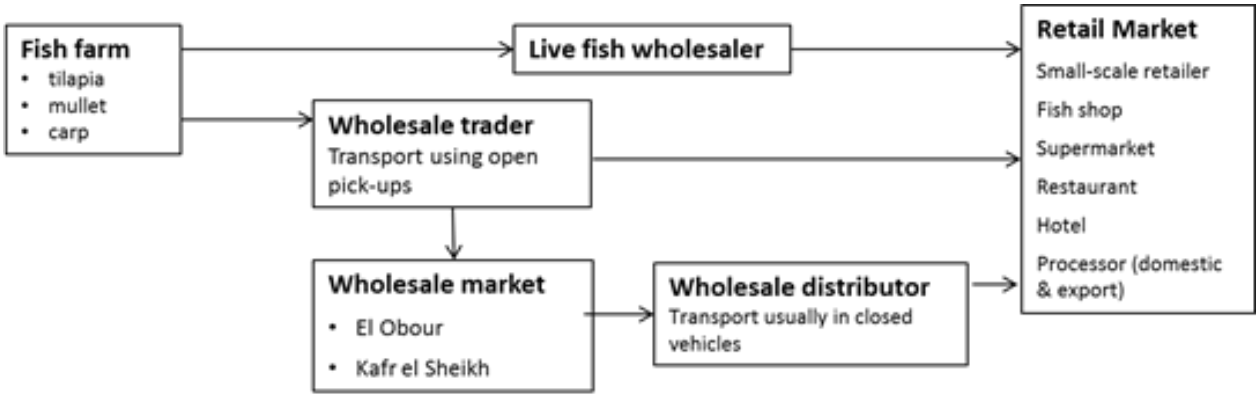
Immediately after harvest, farmed fish is usually sorted and graded by the fish farmer into grades (1, 2, 3 and super for tilapia) and species in plastic crates, each with a nominal capacity of 25kg. The fish is then bought at the pond-side by a wholesaler/transporter who transports the fish in an open pick-up or truck to a wholesale market or distributes it to retailers (Figure 11). Wholesalers often extend credit to the fish farmer, in which case they may also have agreed the sale price in advance. The main reference point for price setting is the wholesale price in Obour market near Cairo, which publishes market information on a daily basis.

Figure 10. Characteristics of the Egyptian aquaculture value chain.



Source: This study, adapted from Macfadyen et al. 2012.

Figure 11. Supply chain for Egyptian farmed fish.



Source: Macfadyen et al. (2011).

Almost all farmed fish is sold as whole fresh fish with no processing or value-addition. The wholesaler usually adds a small amount of ice to the crates at the pond-side and covers the crates with a tarpaulin. However, these measures are insufficient to lower fish temperatures to levels where quality can be preserved. Poor transport and handling conditions also prevail in the wholesale markets, hence quality degrades rapidly and fish must be sold quickly, usually within the same day, or prices must be heavily discounted. The main market channels for consumers are street-side retailers, fish retail shops, fish restaurants (not high-end restaurants) and fish fry shops. Farmed fish can also be found in some supermarkets, particularly in larger chains and hypermarkets. All are usually supplied by wholesale distributors with fish from the wholesale markets or directly from fish farms and transported in open or closed-sided, unrefrigerated, vehicles.

Street-side retailers, many of whom are poor women, buy fish from wholesalers and display them in open metal trays or plastic crates to consumers. In most areas, the retailers appear to prefer smaller fish (grade 3) which are cheaper for consumers. Wholesalers usually extend one day of credit to the retailers but they are in a vulnerable position as they have little choice over the type and quality of fish made available. Under the IEIDEAS project, six groups of women retailers receive financial and technical support to improve their working conditions.

Aquaculture products are sold alongside wild-caught products. Farmed fish are considered to be inferior in quality by most consumers, although they are usually unable to differentiate between farmed and wild-caught fish of the same species. There are currently no regulations requiring the origin of fish to be identified by the retailers i.e. farmed or captured fish. The marketing system for fish is simple but efficient. The market is controlled by a limited number of large wholesalers who determine the market price mainly in response to supply and demand. Farmers are free to sell their products either through wholesalers or directly to retailers. In all major cities there is usually a wholesale vegetable and fruit market where producers can bring their product. Here fish are auctioned daily. Farmers also have agreements with wholesalers who purchase their harvest directly from the farm site. Agreements are usually informal, and in many cases the wholesaler finances the production operations and receives the harvested fish at a price agreed in advance. The products tend to be consumed in the domestic market. Data on fish prices shows how fish prices have only risen slightly over the past 10 years. Mullet commands the highest price, followed by tilapia (first and second grades) and catfish (Macfadyen et al. 2011).

The main exception to the fresh, whole fish supply chain is that a proportion of fish are sold live. Specialist transporters using plastic drums equipped with an oxygen supply buy the fish live at the pond-side at slightly higher prices than normal fish. The fish is then transported to retail and wholesale markets in population centres, where they are sold by retailers using water-filled, shallow metal trays to display the fish. The fish do not survive for a long time as the display conditions are too stressful. Nevertheless, consumers pay a premium for fish that are still alive, indicating the value placed on freshness. This practice started with fish from Fayoum being sold in Cairo; however, it has since spread and fish from many governorates are being sold live in a range of markets.

While there have been a number of proposals to start value-added processing of farmed fish, no one is doing this on a significant scale. Small amounts of farmed tilapia fillets are sold by supermarkets in polystyrene trays covered with cling-film. A major potential constraint to the development of added value products is that Egypt imports large quantities of frozen pangasius (shark catfish) fillets from Vietnam. These cost much less than the production price for Egyptian tilapia fillets (2013 wholesale price of EGP 18/kg for pangasius compared to EGP 40/kg for tilapia) so hotels and catering businesses will tend to choose pangasius for dishes that require plate-sized fish fillets.

Food safety

Egypt does not have an established system for the management of fish health in aquaculture or for regulating the use of veterinary medicines. Additionally, fish farms are obliged to use agricultural drainage water. Fish are transferred from the farm to wholesale and retail markets using wooden or plastic boxes with ice. Quality and hygiene conditions in the markets are generally poor. However, there have been few reports of people falling sick due to the consumption of low quality fish. Provisions on food safety are related to the export of aquaculture and marine products to the EU through a number of ministerial decrees. The decrees address the conditions and measures for fish export to EU, the establishment and implementation of HACCP system. The competent authority to implement the legislation is GOVS.

The legislative framework for residue control is already in place but there is no implementation either by direct inspection at the farm level or in farmed fish products. This is important as there is a widely-held perception that there may be a problem with residues in farmed fish in some areas as a result of using agricultural drainage water. Large quantities of water are collected from irrigated agriculture in low-level drainage canals, which is pumped into higher-level canals for discharge into coastal drainage lakes and eventually into the sea. The drainage water is far from pristine. It is often brackish, contains fertilizer residues and in some cases could be contaminated with heavy metals or pesticides. Many fish farmers and scientists have speculated that growing fish in this water could result in the accumulation of toxins, which would render the fish unsuitable for human consumption. While there is evidence of toxin accumulation in wild fish, it appears that the short life cycle of farmed fish and the fact that farmed fish derive their nutrition from uncontaminated feeds means that fish produced in Egyptian fishponds is safe. Provisional studies by WorldFish in collaboration with the GIZ-funded Safe Food, Fair Food research project and the Rapid Integrated Assessment project indicate that contamination levels are well below the levels that could cause concern. While these rapid studies are reassuring, they need to be supported by a rigorous research program to confirm the initial findings. Poor post-harvest handling practices for farmedfish is of concern. The absence of a cold chain means that fish quality degrades rapidly after sale by fish farmers to wholesalers and from wholesalers to retailers (Goulding and Kamel 2013).

The Egyptian Organization for Standardization and Quality Control within the Ministry of Trade and Industry has the responsibility for establishing, adopting and publishing food standard and codes of practice. All imported food products are tested by the Ministry of Health and veterinary inspection of dairy, fish, meat and poultry products is carried out by MoALR (Rittgers and Mansour 2008). It has been claimed that the standards applied to imported food are identical to those applied to locally produced products. There are strong calls to establish a new Food Safety Authority to be responsible for food safety and consumer protection. Table 17 shows the results of contaminant results for Egyptian farmed fish which was conducted as a food safety mission in the aquaculture value chain in 2012.

Table 17. Contaminant test results for Egyptian farmed fish

Governorate	VC node	Samples	Mercury	Cadmium	Lead	Arsenic	Pesticides
Kafrel-Sheikh	Fish farm	4	ND	<LOQ	ND	1 ND i 3 <LOQ	ND
Sharkia	Fish farm	2	ND	1 ND and 1 <LOQ	ND	ND	p,p-DDE<LOQ
Kafrel-Sheikh	Wholesale	3	ND	1 ND and 2 <LOQ	ND	ND	ND
Cairo	Wholesale	3	2 ND and 1 <LOQ	<LOQ	ND	ND	2 ND and 1 p, p-DDE<LOQ
Kafrel-Sheikh	Retail	9	ND	7 ND and 2 <LOQ	ND	7 ND and 2 <LOQ	8 ND and 1 p, p-DDE<LOQ
Cairo	Retail	10	ND	ND	ND	ND	8 ND, 1 p, p-DDE<LOQ and Chlorpyrifos: 0.01 mg/kg

Note: ND: not detected; <LOQ: below the limit of quantification.
Source: Safe Food Fair Food Project. Food safety in the aquaculture value chain in Egypt: Mission report, 27 September to 12 October 2012, QCAP reference lab, Cairo.

Competitiveness

Table 18 shows an annual growth rate for aquaculture of 8.4%—the highest growth rate among the livestock, milk, poultry and main crop sectors. This indicates strong competitiveness of the sector compared to others, with respect to the supply of domestically produced animal protein.

Table 18. Production and annual growth rates of livestock, milk, poultry, fish and crops, 2000–2010

	Total production in 000 tonnes 2010	Annual growth rate (%) 2000–2010
Aquaculture fish	922	8.4
Capture fish	385	–0.3
Milk	5774	3.4
Poultry	798	3.0
Beef and buffalo	805	4.0
Sheep and goat	122	5.0
Wheat	7169	0.9
Rice	4330	–3.2

Source: FAOSTAT.

Detailed costs and earnings data on fish farm production of tilapia and mullet in other countries against which Egyptian performance could be benchmarked, are not widely available. However, recent global and regional prices for tilapia from a number of sources are provided in Table 19. These prices demonstrate the variability in prices between countries and between markets within those countries. They show that prices in Egypt are generally low compared to other countries. It is important to note that Egyptian prices also vary according to size grade, so poorer consumers tend to buy smaller, cheaper fish. Egyptian fish farmers complain that their selling prices have remained static while their costs, particularly feed costs have risen rapidly, resulting in greatly reduced profitability (Macfadyen et al. 2012). However, this is consistent with a sector where production is rising each year without any attempt to diversify into new markets.

Table 19. Global and regional tilapia, 2010–2011

Country	Prices (USD)	Comments
Malaysia	4.00/kg	Live fish in traditional markets
Malaysia	6.00/kg	Whole fish supermarket
Bangladesh	1.20–2.00/kg	Retail
Middle East	2.10/kg cfr	Whole dressed fish retail
USA	3.53/kg	Frozen fillet wholesale
USA	7.00/kg	Fresh fillet wholesale
USA	5.00/kg	Live whole fish wholesale
USA	1.50/kg	Frozen whole fish wholesale
South Sudan	2.70/kg	Retail whole fish
Kenya (Nairobi)	3.00–5.00/kg	Retail whole fish
Kenya (Nairobi)	8.30/kg	Fresh fillet supermarket
Kenya (Nairobi)	1.85–2.00/kg	Whole fish wholesale
Uganda	1.96/kg	Wild tilapia retail
Egypt	1.70/kg	Whole fish farm gate
	1.76/kg	Whole fish wholesale
	2.04/kg	Whole fish retail
	1.50–2.00/kg	Wild Nile tilapia retail (Mineya governorate)

Sources: Globefish, Kevin Fitzsimmons, Kochi Conference Presentation (2011); Miller et al. (2010); Personal communication from Jim Miller; Personal communication from Patrick Blow (2011).Egyptian prices based on averages across all four governorates sampled by this study and CARE Egypt report for the Mineya price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Value-chain governance

There are a few wholesalers that are key players in the value chain. They are able to control prices as they control large volumes of fish. They sell the fish on behalf of the farmer and avoid the risk of holding a highly perishable commodity; this risk remains with the producer until it is transferred to the retailer. There is no vertical integration (direct ownership) in the value chain, except in one case (El-Marshdy), and there is no contracting to produce fish. Some farmers can be 'locked in' to a wholesaler or a feed supplier through the use of loans and credit, and in this case the farmer will pay higher sales commission or feed prices, and may be obliged to harvest at suboptimal times or to accept low-quality feeds (El-Sayed 2014).

The main points of external governance include the following:

- Fish farms can only be established on land which is not suitable for agriculture and the water supply must be from agricultural drainage canals or lakes. Accordingly, the amount of land available for fish farming is limited.
- GAFRD monopolize the official system for mullet fry catches and distribution. It satisfies mullet fry demand from government fish farms first, then stocks some at Lake Qaroun in Fayoum, and the rest, if there is any, is sold to registered fish farms (2500 fry/fed.) at low prices. However the supply of mullet fry to most private-sector fish farms is from illegal fry catchers who sell through fry traders (Nasr-Allah et al. 2014).
- The lack of a coherent animal health control system for aquaculture means there is no implementation of an effective veterinary drug control and residue monitoring system for aquaculture products (Goulding and Kamel 2013).
- MoALR is supposed to monitor feed ingredients and the final product 'fish feed', however, there are a lot of complaints about the quality of fish feed, especially for those that come from smaller feed mills (El-Sayed 2014).
- Fish import tariff levels at present do not provide much protection to the producers (although they were increased in 2013).
- The policy regarding cage culture of fish in the Nile is vague. There is a need for a well-defined policy regarding cage culture in the Nile based on environmental impact assessment studies in designated areas.


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Externalities

Environmental impacts

The environmental legal framework within which the aquaculture sector works is complex (Table 20). Many of these laws grapple with concerns over the quality and quantity of resources available to different users (Egypt 1982; Egypt EEAA 2001; FAO 2004–2008.). The Ministry of Water Resources and Irrigation (MWRI) has the primary legal responsibility for the planning and management of all water resources in Egypt. Unfortunately, it doesn't consider aquaculture as a legitimate activity that should be allocated a share of available irrigation water. With increasing pollution trends, MWRI is increasing its focus on pollution control and water quality management.

Table 20. Legal framework within which the aquaculture sector works

Environmental law	Date	Objectives	Decrees and regulations	Implementing agency
Law 12 (and its supplementary Law 213/1994)	1984	Main legislation for irrigation and drainage	Has recently been revised and submitted to Parliament	MWRI
Law No. 4 on Environment	1994	Establishment of EEAA and Environmental Protection Fund; requirement of EIA; regulation of air pollution, hazardous waste management and marine pollution	Decree No. 338 of 1995 (Executive Regulation including Prime Ministers Decree No. 1741 of 2005)	MoEA; EEAA
Law No. 102 on Natural Protectorates	1983	Designation and management of natural protectorates	Decrees designating Sites	MoEA; EEAA
Law No. 124 on Fisheries	1983	Management and protection of fisheries and marine animals	Decree No. 8 of 1983 (standards for wastewater discharges to surface waters)	MWRI
Law No. 137 on Labor	1981	Control of work place safety and environment		Ministry of Manpower and Immigration
Law 92/1962 Waste water discharge	1982	Control of wastewater discharge into public sewers	Decree 9/1989	MHUNC

Source: FAO (2009b).

The Ministry of Health and Population (MoHP) has been given a central role in water quality management, especially in setting standards for the quality of potable water sources (River Nile, canals and groundwater wells); drainage water that can be mixed with other water for drinking water; and industrial and sewage treatment plant discharges.

Environment Law No. 4/1994 (Egypt 1994) creates the obligation to undertake an environmental impact assessment (EIA) under certain conditions. Aquaculture is designated as an activity 'which may have a noticeable impact on the environment' and requires an EIA to be submitted before approval can be given and before work can commence. This law also requires that any establishment of this nature prepares an environmental register which must be regularly updated to record the impact of the establishment's activities on the environment. The executive regulations determine the standard form of the required register, the timetable required to keep it up-to-date and the data to be entered (Sadek S., personal communication).

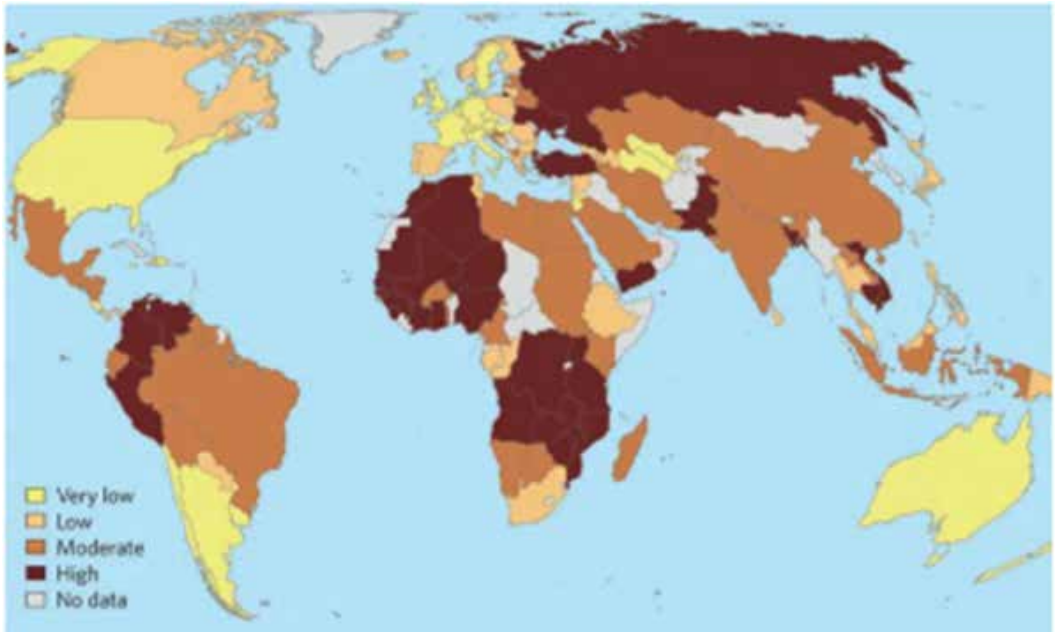
These multiple laws present some difficulties for aquaculture farmers. There is a risk that the EIA becomes just one more in a series of bureaucratic hurdles for the farmer/entrepreneur, each of which has to be resolved independently with each institution involved: EEAA, the Ministry of Agriculture and Land Reclamation (MoLAR), Ministry of Water Resources and Irrigation, GAFRD and other local competent administrative authorities (FAO 2009b).

Sector ministries and governorates are the competent administrative authorities for EIA, as they possess the executive powers in relation to development authorization. Additionally, they are required by Law 4 and its executive regulations to conduct the screening of projects (METAP 2000). The central EIA department of the EEAA is responsible for supervising the screening process, managing the review of EIA reports (either by undertaking reviews itself or by assigning independent bodies or individuals to do so), taking decisions on the acceptability of EIA reports and giving an opinion on the development and proposals for mitigation measures. EEAA also has the responsibility for issuing EIA guidelines.

Limited land and water resources (physical and self-imposed by existing legislations and policies), indicate that the way forward for Egyptian fish farmers will be to intensify production and take full advantage of new technologies and management procedures. However, with intensification comes higher environmental risk of adverse effects on the environment, higher production risks from higher levels of inputs, and the increased need for water quality and fish health management. EIA may come to be seen by the sector as a key tool in managing this transition in a way that is sustainable and protects the resources from the increasing pressures of its multiple competing users (FAO 2009).

The impacts of climate change on aquaculture are more complex than those on terrestrial agriculture because of the much wider variety of species produced (Brander 2007), but different to fisheries because of the greater level of control which can be maintained over the production environment. Changes in rainfall will cause a spectrum of changes in water availability, ranging from droughts and shortages, to floods and will reduce water quality, while salinization of groundwater supplies and the movement of saline water further upstream in rivers caused by rising sea levels will threaten inland freshwater aquaculture (IPCC 2007). Sea-level rise will be a major threat for freshwater (and brackish) aquaculture of tilapia and other species in the Nile Delta in Egypt, affecting the largest aquaculture production area in the region. Figure 12 shows the vulnerability to climate change of the aquaculture and fisheries sectors of national economies. Egypt is shown as moderately vulnerable.

Figure 12. Vulnerability of fisheries and aquaculture to climate change.



Source: Allison et al. (2009).

Aquaculture development strategies and activities

A new Strategy for Sustainable Agricultural Development (SADS) towards 2030 was developed for Egypt. The SADS document towards 2030 has been prepared to reflect national objectives and orientations, coordinated by the Agricultural Research and Development Council (ARDC), with support from Food and Agriculture Organization (FAO), and inputs from International Fund for Agricultural Development (IFAD) and World Bank. The Vision of SADS 2030 is: 'To achieve a comprehensive economic and social development based on a dynamic agricultural sector capable of sustained and rapid growth, while paying special attention to helping the underprivileged social groups and reducing rural poverty'. The Mission of SADS 2030 is: 'Modernizing Egyptian agriculture based on achieving food security and improving the livelihood of the rural inhabitants, through the efficient use of development resources, the utilization of the geopolitical and environmental advantages, and the comparative advantages of the different agro-ecological regions' (MoALR and FAO 2013).

Increasing per capita animal protein consumption by 4 g/day by 2030 is one of the main objectives of developing animal, poultry and fisheries production; and reconstituting the animal food basket from different sources in favour of the least-costly local sources. To achieve these goals, the strategy is based on achieving the following objectives:

- sustainable development of lake fisheries production;
- expanding fishing in the Mediterranean into the exclusive economic zone, extending to 200 NM;
- expanding aquaculture activities to increase production to 1.39 million tonnes by 2030;
- increasing sea fisheries production to 200,000 t by 2030.
- improving quality of agricultural products to meet market requirements;
- establishing and applying quality standards for agricultural products, and expanding application of sorting, grading and packaging processes;
- applying information and telecommunications modern technologies;
- improving marketing facilities and services;
- improving pre-and post-harvest practices to improving product quality and marketing efficiency;
- applying modern techniques and practices in monitoring, analyzing and the prediction of natural and marketing risks and developing risk mitigation measures;
- rationalizing the regulatory role of the government in exercising control over agricultural inputs and outputs policies, as well as in consumer protection;
- improving production to market chain linkages.

Research and development partnership landscape

The following organizations and individuals were identified as important stakeholders for the development of aquaculture as part of a stakeholder and risk analysis for the IEIDEAS project: fish farmers, prospective fish farmers, wholesalers/transporters, retailers, input suppliers (feed companies and mills, hatcheries), producer organizations (Aquatic Union of Fisheries Coops and local fish farmers associations), national government, local government, Ministry of Agriculture and Land Reclamation (Central Laboratory for Aquaculture Research—CLAR, General Organization for Veterinary Services—GoVS, Agriculture Research Center—ARC, General Authority for Fisheries Resources Development—GAFRD), Ministry of Irrigation, Ministry of Environment, Ministry of Social Affairs, Universities (Kafr el Sheikh, Suez, Zagazig), national NGOs, local NGOs, supermarkets, processors, hotels and catering and chefs' associations.

GAFRD's main responsibility is to help fish producers by providing technical support and extension services. It also issues land leases for aquaculture land placed under its control and fish-farm licenses for all fish farms whether on GAFRD land, other government-owned land or on privately-owned land.

CLAR falls under MoALR's Agriculture Research Center and is responsible for conducting research in different aspects of aquaculture with the aim of increasing aquaculture production, in addition to offering training and extension services. Its research areas cover: aquaculture methods, fish physiology, fish processing, breeding and genetics, nutrition and feed technology, biology, health and diseases, limnology, ecology, and aquaculture economics. It has two experimental stations in Salhia (Alexandria) and in Sakha (KafrelSheikh).

The Institute of Fisheries and Oceanography as well as the Ministry of Education and Scientific Research conduct research on fish biology, stock assessment, fish technology, fishery economics, aquaculture, limnology and physical oceanography.

WorldFish has a regional research centre for Africa and West Asia at Abbassa, Sharkia. It is an international public institution working on improving sustainable aquaculture technology and on more productive and resilient small-scale fisheries through applied research, training and extension services.

Egyptian universities are governed by the Ministry of Education and Scientific Research. Some have basic fisheries and aquaculture research programs (El-Gayar 2003; FAO 2011b). Suez Canal offers an aquaculture program focusing on marine aquaculture and operates a marine fish hatchery. Steps were taken to establish a college for aquaculture and fisheries sciences in the city of Suez. Two departments at the University of Alexandria are involved in aquaculture and fisheries; the fisheries department of the college of agriculture offers an undergraduate program in aquaculture, while the oceanography department of the faculty of sciences carries out research in fisheries sciences, oceanography and aquaculture. Many other universities offer courses in aquaculture as part of their animal production course requirements. Graduate student who work in aquaculture and fisheries research institutes take their courses at the university and do their field research at the institutes.

Opportunities for pro-poor fish value chain research and development

The period since the January 2011 revolution has been challenging for the Egyptian economy and the prosperity of its people with lower economic growth, foreign exchange deficits and higher unemployment. Economic growth has fallen from around 6% in the pre-revolution years to around 2% since then. Food prices rose by 10% over the last year while unemployment reached 13% in late 2012 (9% in 2010).

Food insecurity is rising and while the highest poverty rates are in Upper Egypt (51% compared to a national average of 25%), poverty has also increased in urban areas by 40% between 2009 and 2011. One of the main issues facing vulnerable households is poor dietary diversity as they reduce consumption of more expensive food items (e.g. animal sourced foods such as fish) and rely instead on energy dense foods, such as subsidized bread and cooking oil, which can cause obesity in adults. The childhood stunting rate (6 months to 5 years old) has risen (from 23% in 2005 to 31% in 2011) and childhood anaemia and obesity rates in women have risen also.

In contrast to many other sectors, Egyptian aquaculture has grown rapidly, with annual production increasing by around 10% in recent years to a current first-sale market value of around USD 1.5 billion. Over 100,000 people (FTE) are now employed across the value chain, mostly in rural areas and at least 50% of these are youths (under 30 years old) (Macfadyen et al. 2011). Aquaculture-produced fish, particularly small tilapia is one of the cheapest sources of animal protein in Egypt. Increasing productivity and production on existing fish farms will result in more employment of poor people, increased incomes for those working and employed along the value chain and greater availability of fish for poor consumers.

The area available for aquaculture development is unlikely to be expanded without major changes in policies over where and how aquaculture can be carried out. Grey areas such as policies over cage farms and the use of groundwater in 'desert farms' for aquaculture need to be clarified and resolved.

Current research and training efforts are focused on developing faster growing strains and helping fish farmers to grow their fish more efficiently. While these will generate a greater proportion of large fish at harvest, research is needed to see that demand for small fish from poor consumers is also being met

Current land leasing policies mean that aquaculture is an SME enterprise. Aquaculture by the poor has been neglected and needs research and development to identify appropriate systems.

While market development could mean the development of an added-value processing sector, the first step must be the improvement of post-harvest handling practices, resulting in extended shelf-life and better distribution of fish throughout the country.

Annotated database

Databases and other information sources

Central Agency for Public Mobilization and Statistics (CAPMAS)

Website: www.capmas.gov.eg

Under Presidential Decree no. 2915 of 1964 the Central Agency for Public Mobilization and Statistics is considered the official source for providing all the state bodies, organizations, universities, research centres and international organizations with the data, statistics and reports that help in planning, development and evaluation processes as well as the preparation of studies, policy formulation and decision-making. CAPMAS issues regular reports through its website: http://www.capmas.gov.eg/. These contain statistics and information about all aspects of Egyptian life from household expenditure to industrial development.

El-Obour market

Website: www.obourmarket.org.eg

El-Obour wholesale market publishes daily price information on auction prices and volumes of fish passing through the market.

GAFRD

Website: www.gafrd.org

GAFRD is responsible for the collection of data from both fisheries and aquaculture. It issues a statistical yearbook with estimates of fish production and other essential data. This information is relayed to the Food and Agriculture Organization (FAO) and is included in global fisheries and aquaculture databases.

GAFRD maintains a database of fish farms. This covers fish farms on land leased from GAFRD, on land leased from other government bodies, such as local authorities and on privately owned land. However, as many fish farms are unlicensed, particularly those on privately owned and local authority land, the database is incomplete.

Geography and climate

The Arab Republic of Egypt is located in northern Africa, bordering the Mediterranean Sea, between Libya and the Gaza Strip, and the Red Sea north of Sudan, and includes the Asian Sinai Peninsula. Total area is 1,001,450 km2 (land: 995,450 km2, water: 6000 km2). Coastline is 2450 km. The climate is desert: hot, dry summers with moderate winters. The terrain is a vast desert plateau interrupted by the Nile Valley and Nile Delta. The highest point is Mt. Catherine in Sinai (+2629 m) while the lowest point is the Qattara Depression in northern Egypt (–133 m).

The main natural resources are: petroleum, natural gas, phosphates, manganese, limestone, gypsum, talc, asbestos, lead, zinc and rare earth elements. Only 2.87% of its land area is arable and 0.79% is under permanent crops. The total irrigated land area is 34,220 km^2 supplied by 57.3 km^3 of water/year.

Source: www.cia.gov/library/publications/the-world-factbook/geos/eg.html

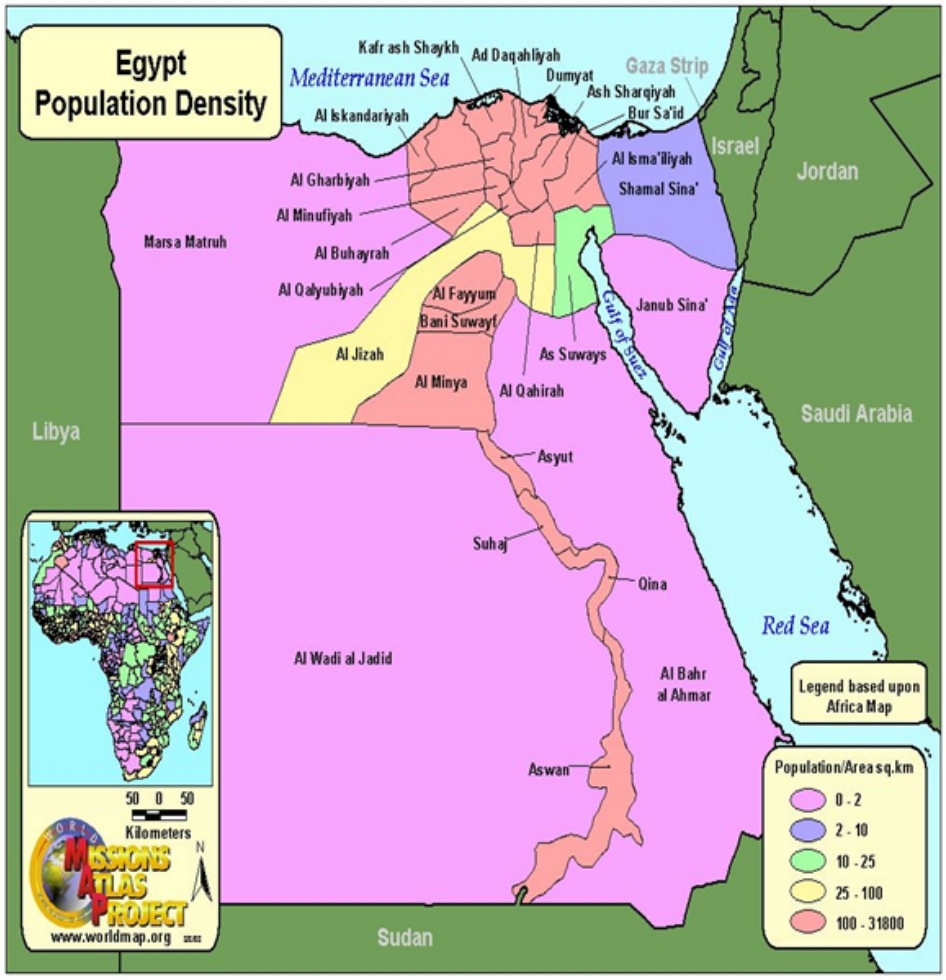
Figure 13. Geography and climate of Egypt.

Source: Health Systems Profile—Egypt, Regional Health Systems Observatory-EMRO, World Health Organization (2006).

Population density

Most of the population is centred on the Nile River and the Mediterranean Sea.

Figure 14. Population density in Egypt, 2012.



Agricultural production

Table 21. Total value of agricultural production (in million EGP), 2005/06–2010–2011

Item	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Total value of livestock production	49571	55139	64940	68987	77253	84538
Total value of plant production	78424	89858	109792	108657	117477	148501
Total value of insect products	118	121	120	132	129	132
Total value of fish production	9305	10827	10814	11661	14495	16819
Total gross value of agriculture production	137419	155945	185667	189438	209354	249989
Total value of agriculture input	35053	39638	48911	51384	58641	70313
Net agriculture income	102366	116307	136756	138053	150713	179676

Source: CAPMAS (2013), Author calculation. Note: The exchange rate of the Egyptian Pound to US Dollars = 6.96 EGP (March 2014).

Aquaculture and fisheries production

Table 22. Aquaculture and fisheries production statistics

Total production	
Fisheries production	354,237 t
Aquaculture production	1,017,738 t (74% of total production)
Total fish production	1,371,975 t
Imports	335,000 t
Exports	16,000 t
Total available fish supply	1,691,000 t (60% from aquaculture)
Per capita supply from local production	16.48 kg/person peryear
Per capita supply from total available fish supply	20.55 kg/person per year
Aquaculture production by species	
Tilapia	768,752 t (75.54% of total)
Mullet	129,651 t
Carp	67,065 t
Catfish and other freshwater fish	14,236 t
Sea bass and sea bream	28,604 t
Meagre	8319 t
Shrimp	1109 t
Fish farm areas	
Kafr El Sheikh	97,380 feddan
Damieta	63,000 feddan
Port Said	52,318 feddan
Sharkia	33,411 feddan
Behera	12,751 feddan
Alexandria	4685 feddan
Ismailia	4639 feddan
Fayoum	2750 feddan
Suez	1422 feddan
Total	272,970 feddan (114,647 ha)
Production system	
Pond-based	720,412 t
Intensive tanks	3895 t
Cages	249,385 t
Rice–fish	34,537 t
Ownership	
Private farms	1,008,299 t
Government farms	9500 t

Source: GAFRD.

Expenditures

Table 23. Percentage of expenditure on food and non-food items by governorate, 2010–2011

Governorate	% of non-food non-durables exp.	% of food exp.	% of meat exp.	% of fish and sea food exp.
Cairo	48.36	33.47	29.95	7.64
Alexandria	46.93	37.16	27.67	8.76
Port Said	36.89	35.84	26.42	14.75
Suez	42.38	40.28	28.06	10.47
Helwan	45.05	42.05	36.30	7.21
Six October	44.42	37.01	35.50	7.83
Demitta	43.17	40.51	24.06	17.00
Dakahllia	42.22	42.32	23.77	7.56
Sharkia	41.45	43.52	27.02	7.04
Qualubia	47.09	34.80	28.35	6.76
Kafr el-Sheikh	41.46	39.70	25.52	10.01
Gharbia	46.72	37.72	26.74	7.39
Monfia	47.23	36.11	29.68	6.59
Behera	39.17	43.31	29.18	6.98
Ismalia	44.64	42.64	30.93	9.40
Giza	50.29	35.50	31.42	7.49
Bain Sowif	41.35	43.43	34.05	5.82
Fayoum	43.89	40.09	30.06	5.77
Menia	39.66	43.86	35.30	6.71
Assiut	41.26	42.85	32.63	6.96
Sohaj	38.28	46.32	32.80	6.99
Qena	40.90	45.66	30.69	6.39
Aswan	39.82	46.77	27.61	6.35
Luxor	39.65	40.25	32.82	7.02
El Bahr ElAhmer	43.85	40.50	27.67	11.88
El Wadi El Gedid	39.71	45.83	36.20	7.99
Matrouh	32.77	53.84	22.52	8.83
North Sinia	39.67	45.14	23.41	10.51
South Sinia	41.31	38.74	25.48	8.95
Average	42.40	41.21	29.37	8.38

Source: Computed based on data from HIECS(2010/2011).

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