Farmed Animal Advocacy in Egypt

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EXECUTIVE SUMMARY

Egypt is a major producer in animal agriculture and aquaculture, producing more fish from aquaculture than all other African countries combined, and it is one of the leading producers of broiler chickens (1). Despite this monumental production, Egypt remains a net food importer, including many types of meat. Unfortunately, this is not governed by specific animal welfare legislation, only the occasional mention in other legislative provisions. In Egypt, minimal legal protections are extended to farmed animals. This means that there are a wide variety of potential improvements that should be made to Egyptian animal protection regulations and standard practices within these industries.

However, given the political and economic environment, direct policy advocacy or corporate engagement is difficult. The sale of Egyptian meat and aquaculture products is relatively informal, with wholesalers being the most common go-between for producers and markets. The political focus is on food prices and human concerns (2). If more advocacy groups or individuals are well-placed to make progress in these domains, some significant improvements could be made. However, this is ultimately a judgement call surrounding the positioning and opportunities available to a particular group, which falls outside the scope of this report.

Considering these potential constraints, we have focused on high-priority but potentially more tractable campaigns. We have highlighted the main uncertainties and additional information

that could be gathered early to inform you of the relative priority of the work. The three priority asks are:

- **Water quality for farmed fish.** The main target for this would be earthen pond systems, which represent 85% of total production, mostly farming Nile tilapia. Improvements would require monitoring systems for water parameters such as dissolved oxygen, pH, and ammonia levels and then providing farmers with information and/or training on rectifying any sub-optimal parameters. We remain uncertain about the best way to implement this ask. Still, one significant possibility is working cooperatively with farmers, similar to the Fish Welfare Initiative's work in India, Ethical Seafood Research's ongoing work in Egypt or FAI's Tilapia Welfare Project's current work in many places worldwide. Please note that ESR is currently (2025 production cycle) carrying out a pilot study in partnership with FAI Farms and Aquavet Egypt to demonstrate to farmers the difference monitoring water quality makes to their farm's performance.
- **Banning the sale of live chickens to consumers.** In Egypt, between 64 and 70% of chicken is sold live, and approximately 30% is sold frozen (3,4)(source is from 2017 and 2003, respectively). Given the large number of birds sold in this manner (about 896 million) and the severity of the experience, the total cruelty the practice represents is quite staggering. Unfortunately, even if banned, these birds would not benefit from slaughter methods such as controlled atmosphere stunning (CAS), so this would resolve many but not all problems associated with slaughter. The practice also benefits public health and farmers due to the expected reduction in bird flu outbreaks. While this would benefit itself, we expect the existing support and motions from the government to work on this issue, which will make this a much easier first policy ask under a 'One Health' framework.
- **Quality control standards for domestic fish feed mills.** There are 100 privately owned feed mills, concentrated in seven governorates, which provide 95% of Egypt's fish feed (5). This concentration points towards an opportunity to work with a small number of feed mills to enhance feed formulations and pelleting methods to improve the welfare outcomes for fish on a much broader scale. The recent shift to extruded fish feed is a key example, with most semi-intensive pond tilapia farmers (~70%) using extruded pellets (6). This has the potential to result in better welfare and commercial outcomes; however, this still means most small farms do not use extruded feed. Unlike the two asks above, developing improved formulations and methods will be massively constrained by the relative cost of the feed, as fish feed constitutes the majority of any fish farm's operating costs (70–95%) (7). This makes this question a more complex, albeit still win-win, solution for producers and feed mills. Further research and development would be needed to explore which changes to feed may be

tractable and important for welfare outcomes. This is currently a problematic angle for those without sufficient knowledge of tilapia welfare.

Our research has repeatedly found scarce information about existing welfare conditions and agricultural policy. This means we face more uncertainty than we typically do in our study. To overcome this uncertainty, we have identified three main priorities. All of these priorities appear to be very strong - even in the face of uncertainty, we expect each to be capable of improving the lives of millions of farmed animals.

These priorities can be selected and adapted based on on-the-ground conditions, including existing welfare conditions, the policy landscape, and stakeholder views. If you want to advocate for farmed animal welfare in Egypt, none of these campaign opportunities may suit your circumstances, then we encourage you to contact Animal Ask and Ethical Seafood Research so we can help you select the best campaign for you.

LEGAL AND MARKET CONTEXT

Legal context

The current protections conferred by Egyptian legislation to animals are entirely inadequate. Egypt is a member of the World Organisation for Animal Health (WOAH), yet it is not in regular compliance with the welfare standards set by the organisation. There is no animal welfare act in place, and no secondary legislation mandating specific standards or legislation recognising animal sentience exists. The Ministry of Agriculture and Land Reclamation is responsible for animal health. Still, no government ministry or government body has been assigned overall responsibility for animal welfare specifically, even if welfare is implied to be part of health.

Although some laws offer some protection and mandate humane treatment of animals, they are not species-specific and do not align with the typical models of welfare used for legislation, such as the Five Domains. For example, the Egyptian Constitution mandates the humane treatment of animals, and the Agricultural Law of 1966 prohibits overworking draught animals (8). There are also laws governing the transportation of animals (Ministerial Decrees No. 498 (2013), No. 847 (2012), No. 2128 (2011)). However, they only address issues related to managing the spread of diseases.

Additionally, the Egyptian criminal code prohibits deliberately killing, unjustifiably killing or causing “enormous harm” to riding, drawing, or carrying animals, as well as any kind of cattle. It also prohibits poisoning fish, including wild fish (9). This would be extremely useful for advocacy if it were literally and strictly enforced, though this does not appear to happen in practice.

THE ANIMAL FARMING INDUSTRY IN EGYPT

The animal farming industry in Egypt is undergoing significant changes and development. Population growth, increasing urbanisation, and higher purchasing power have increased the demand for meat consumption (10).

The industry encompasses various subsectors, including poultry, livestock, and aquaculture. The livestock and fishery sectors account for 37.5% and 11% of the total value of agricultural production, respectively (10).

Egypt's Sustainable Development Strategy, Vision 2030, emphasises the livestock sector as a pivotal element in the nation's economic growth and sustainability. The strategy outlines objectives to increase animal protein consumption and enhance livestock production to meet domestic demand and reduce reliance on imports. A specific target is to increase per capita animal protein consumption by 4g/day by 2030, highlighting the focus on developing animal, poultry, and fisheries production (11).

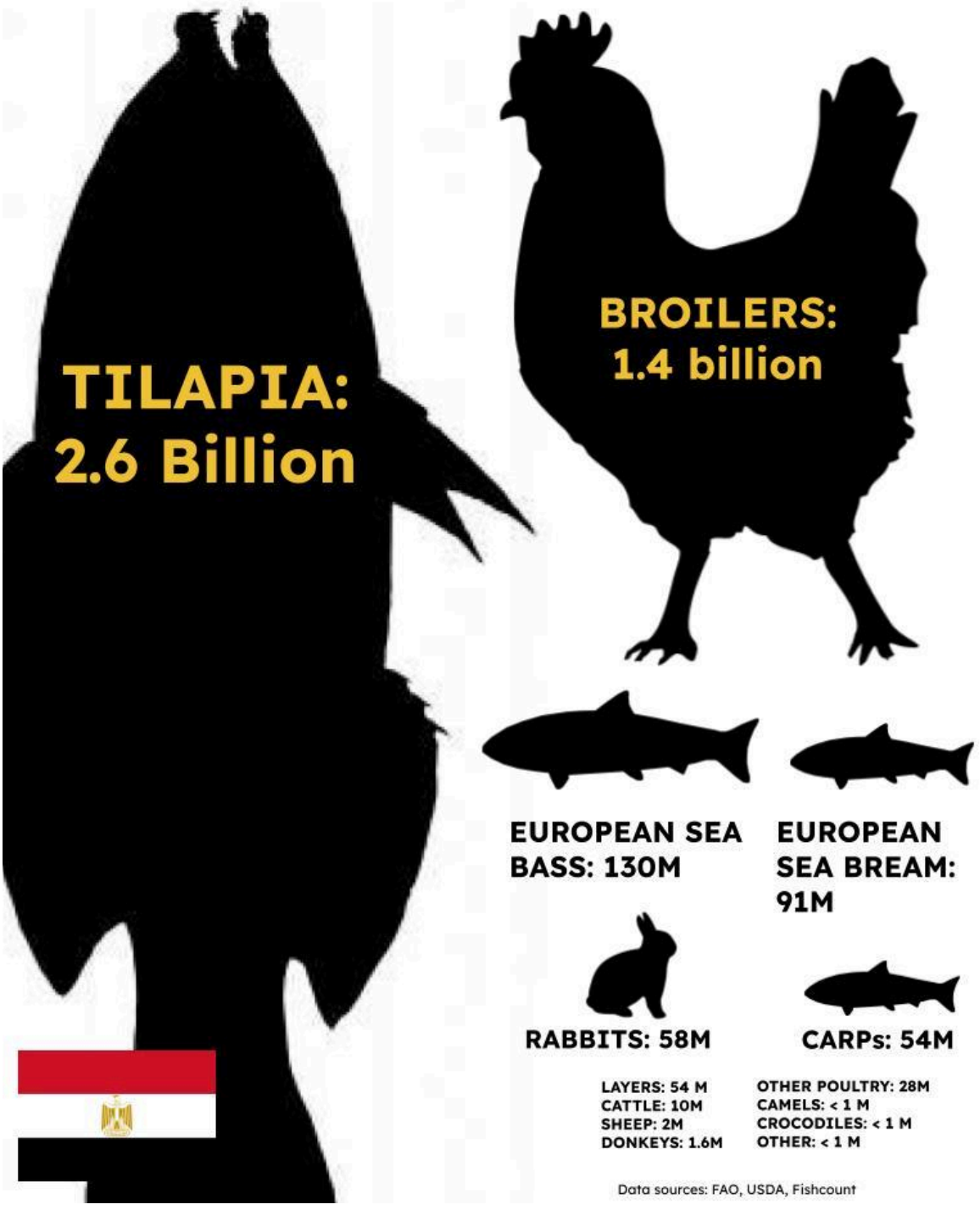
This indicates that the future of animal farming in Egypt is heading towards increased industrialised factory farming. This causes a wide variety of problems for the welfare of animals, such as restricted freedom to express natural behaviours.

The number of animals consumed in Egypt was surveyed to determine the most impactful campaigns. It is important to note that statistics on the animal population vary significantly depending on the source. These numbers are drawn from national statistics from The Central Agency for Public Mobilization and Statistics (CAPMAS), the Ministry of Agriculture and Land Reclamation, or FAOSTAT. In some cases, they are estimated from different sources.

- **3.4 billion fish are farmed in aquaculture** (12)**.** Nile tilapia is the primary cultured species in Egypt, contributing about 65.15% of Egyptian fish production (13). As of 2016, 80% of aquaculture was produced in semi-intensive systems (14), and intensity is expected to have increased since then.
- **1.5 billion broiler chickens**, 76% of which are raised in intensive systems (10,15).
- **54.4 million laying hens** (4)**,** half of which are reared in caged housing systems (16,17).
- **58 million rabbits and hares are slaughtered per year.** Rabbit production is primarily made up of “family” farms and smallholder farms (18,19).
- **43 million pigeons and other small birds** are slaughtered every year.
- **25.8 million ducks and geese** are slaughtered every year.

ANIMALS FARMED IN EGYPT

This infographic shows the numbers of farmed animals alive in Egypt at any one time, based on data from 2017-2023. All numbers represent animals alive at any one time, except for fish, broilers and rabbits which represent animals slaughtered per year (production).



Data sources: FAO, USDA, Fishcount

Poultry production

Poultry is one of the leading agricultural industries in Egypt, producing over 1.3 million tonnes of meat and having a self-sufficiency ratio of 95% (20). Egypt's per capita consumption of white meat is estimated to be 21.3 kg per year, or 58.5 grams per day (21).

Industry structure

In 2017, most poultry was sold live, representing 64% of the market share. Meanwhile, chilled or frozen poultry slaughtered in licensed abattoirs represent 36% of the market share (4). Thus, the value chain continues to pass from farmer to broker and wholesaler rather than through slaughterhouses.

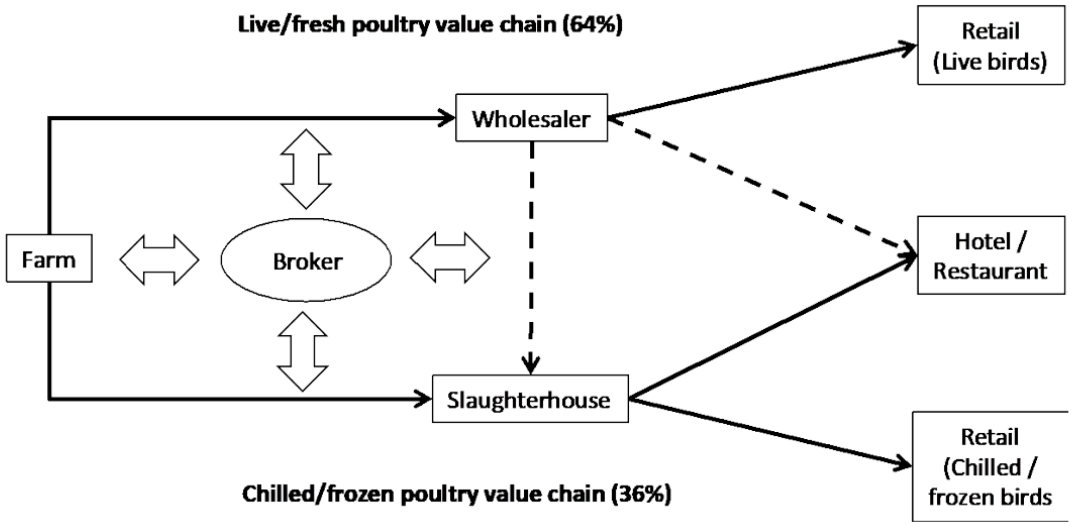


Figure: Main marketing channels for broilers. Source: (FAO, 2022)

Input Supply

Broiler production is by far the largest segment of Egypt's poultry industry. In 2018, total production amounted to about 849 million broilers. Of these, 690 million came from the commercial broiler industry (81%), while extensive farmers produced about 159 million chickens (19%) (4). This has been growing rapidly, with estimates from the FAO increasing to 1.4 billion in 2020 (10).

Broiler production starts from grandparent flocks, with six poultry companies (Al Wataneya, two for CPC, Al Wadi, Al Aasema and Tiba) having the capacity to produce 560,000 broilers. Grandparents are imported into Egypt from different parts of the world because the day-old chicks are under supply contracts with significant genetics companies (22).

Osman et al. (2016) outline three groups of local chickens according to their morphological appearance (23). The first group includes native breeds, such as Fayoumi and Dandarawy. The second consists of mongrel fowls, such as the Baladi and Sinai, which originated from hybridisation among old local strains and exotic types (24). Body weight gain for Balady

chickens is ~ 8 to 9 grams per day, and for Fayoumi, it is ~ 12g/day. Native breeds usually do not exceed a weight of 1.2kg at slaughter (expert interviews).

The third group includes improved native breeds, local and pure exotic chicken strains that produce different traits. Examples include the 'Golden Montazah' breed, which is selected for high egg production (25), the 'Bandarahh' bred for meat production, and the 'Doki-4' bred for egg and meat production (26).

The broiler breeder strains the Egyptian broiler industry typically uses are Ross-308, Cobb-500, Avian48, Indian River, Hubbard Classic, Starbro, and Arbor Acres (27). None of them are approved higher welfare breeds covered within the Better Chicken Commitment (28). Due to their selective breeding, they are subject to various health and welfare problems.

Production

Farm production systems are split between big commercial farms with intensive conditions and extensive farming by small-scale household poultry farms. Commercial poultry farms produce more and physically larger birds, accounting for around 84% of chickens produced in Egypt. The FAO estimates approximately 30,000 registered intensive poultry farms and around the same number of unregistered farms in Lower Egypt (20). According to the Economic Affairs Sector statistical report of MALR in 2015, there are 360 operational and 65 non-operational hatcheries who supply commercial poultry farms, with a further 549 municipal hatcheries that supply backyard farmers (22).

Flock sizes in industrial and commercial systems vary from 5,000 at the small-scale level to 100,000 for integrated producers (4), operating five to six cycles per year (22). Based on surveys undertaken in Qalyubia and Menoufia (29), covering 48 farms of various sizes and capacities, most commercial chicken houses have an area of 500 square metres and a production capacity of about 5,000 broilers per cycle.

Trade

Farmers sell chickens to a broker who controls a particular area and is the main actor in the marketing process. The broker is an intermediary between the producers and wholesalers, although some farmers deal directly with hotels and restaurants. Producers work with a broker to find a wholesaler (or slaughterhouse) and negotiate the quantity and price of the chicken to be sold (4). Wholesalers and brokers typically source chickens from farms in the same district or governorate.

Slaughterhouses struggle to gain as much market share as live wholesale markets, brokers, and farmers because slaughterhouses purchase birds with a payment delay of up to 45 days. After all, they sell frozen birds on credit to markets. This leads to many small and

medium-sized producers unwilling to sell through slaughterhouses due to extended payment delays and lack of cash (22). To operate sustainably, slaughterhouses are pressured to run at capacity as often as possible. However, the current total capacity of slaughterhouses is sufficient to cover the whole broiler market if there is a sudden shift in compliance. The existing 325 poultry slaughterhouses can process 3.28 million birds per day (4) or about 1.2 billion a year, above the 2018 production figures of 849 million broilers. Though this does not include other species of poultry.

Aquaculture

Industry structure

The central fish production governorates—Kafr El-Sheikh, Sharkia, Beheira, Damietta, and Fayoum—are responsible for more than 80% of Egyptian aquaculture output. The value chain comprises feed mills, hatcheries, fish farms, intermediary traders, and retailers. Since farmed fish are virtually not exported, trade is relatively simple and internal compared to aquaculture value chains in other countries.

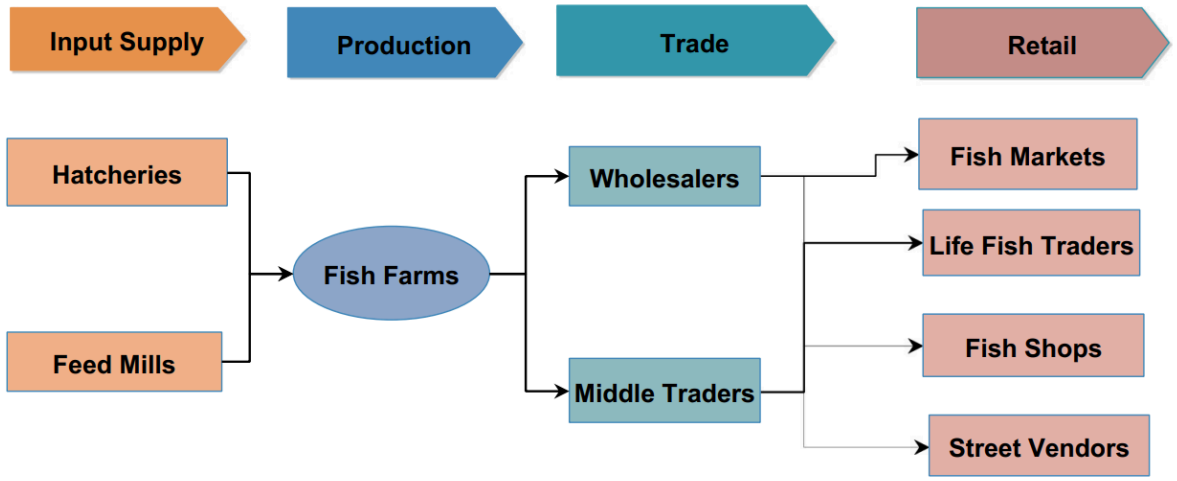


Figure 1: Aquaculture value chain in Egypt and linkages among the main actors. Source: (Macfadyen et al., 2011; Macfadyen et al., 2012b)

Input supply

There are around 440 hatcheries (30) in Egypt, typically privately owned, which produce all-male tilapia fry and fingerling and are then mostly sold to fish farms at an average weight of 0.2-0.5 g for fry and 1-5 g for fingerlings. Seed is primarily made up of fry (93%) rather than fingerlings (7%) (31). On average, hatcheries have a size of 1.7 ha and around 10,700 brooders per hatchery (32), producing 8 million seeds (31). However, hatcheries in Kafr El Sheikh have the highest seed production per unit area (9.45 million seeds per ha), making them more intensive and high-yielding than hatcheries in Beheira and Sharkia.

The feed market is even more concentrated, with 105 feed mills providing 95% of fish feed (33). Feed mills mainly produce floating, extruded or sinking pellets (mainly for tilapia), with crude protein levels ranging between 25 and 45% (34). Feed mills in Beheira and Sharkia produce only pelleted feed, while mills in Kafr El-Sheikh produce both pelleted (29%) and extruded feed (71%) (31). A considerable amount of feed ingredients are imported, accounting for between 50 and 99% of feed ingredients used in aquafeed production in Egypt (5). Imported fish feed is more expensive than locally produced feed, so farmers use locally made fish feed (14), although the ingredients are often imported.

Production

Egypt is the seventh-largest aquaculture producer in the world by production volume and the largest in Africa, accounting for 73.8% of African aquaculture by volume and 64.2% by value (1). The rate of per capita fish consumption in Egypt continues to increase yearly as citizens seek cheaper sources of animal protein to replace meat and poultry, which price rises have hit due to inflation (35).

The aquaculture industry has expanded rapidly in the past decade, from 1.37 million metric tons (MT) in 2016 to 1.62 million MT in 2020, an increase of 18.2% (33). Fish production (2.5 million MT) is projected to reach 5 million MT by 2030 and 7.6 million MT by 2050 (36). The vast majority are the main farmed species, Nile tilapia, who are widely farmed due to their ease of culture, rapid growth, and palatability (37).

Table 1. Egyptian inland water aquaculture production by source 2015–2018 (tonnes).

Production source	Species	2015	2016	2017	2018
Freshwater	Nile tilapia	75,513	100,309	112,493	121,100
	Mullets *nei*	42,179	38,776	27,919	31,371
	Silver, bighead carps *nei*	34,606	80,909	64,685	66,900
	Common carp	30,000	50,000	45,000	47,000
	African catfish	6,000	6,000	5,556	5,000
Brackish water	Nile tilapia	800,000	840,000	854,808	930,344
	Cyprinids *nei*	30,000	70,000	64,500	67,000
	European seabass	14,343	24,498	30,720	24,914
	African catfish	1,455	1,627	2,749	1,836

Almost all Egyptian aquaculture output is produced by privately owned small and medium-sized farms (38). Egypt's central production system consists of the following types of production:

- Extensive aquaculture: restocking of large lakes with fish fry and fingerlings, stocking of grass carp in the Nile, as well as in enclosures and earthen ponds. Extensive fish farming relies on natural food sources in water, such as phytoplankton and zooplankton, and they have low use of inputs. As such, extensive forms of agriculture tend to need low capital investment, which generates low yields of approximately 250 kg/ha (14).
- Semi-intensive aquaculture uses pellets as supplemental feed, accounting for approximately 86% of Egypt's total aquaculture production (14). However, this figure is likely outdated as it relies on data from 2009. Farm sizes, stocking densities, management practices, and systems vary significantly between farms. However, the most common semi-intensive method of Egyptian aquaculture is pond farming.
- In Egypt, intensive aquaculture typically occurs in concrete ponds, tanks, greenhouses, and sometimes cages. Although the market share of these systems is still limited, accounting for far less than 10% of national production, it is expected to increase as demand and the industry continue to grow over the next 20 or more years. Intensive tank tilapia culture in Egypt is growing slowly, especially in more arid areas where water is limited (14).
- Integrated agriculture- aquaculture production systems in which agriculture and aquaculture systems are used concurrently or sequentially. This is only practised in a few sites in Egypt, such as Fayoum and Sharkia.

Trade

Fish are harvested by mobile harvest teams, contracted directly by fish farms when ready to take their fish to market. The fish are then bought by traders and wholesalers who either collect them from the farms themselves or have the fish delivered to them by the farmers or the harvest teams. Most farmers (76%) use wholesalers as their preferred retail route, 7% use wholesalers with other outlets, 8% use intermediaries, and 9% have their outlets (39). These more prominent traders distribute fish to retailers and food services (e.g., restaurants) within one day of purchase. In 2012, these traders sold 99% of the fish bought, amounting to an average sales volume of 1,119 t/ year per trader and bringing them around EGP 11.9 million in revenue (40). Retailers sell live or fresh fish (with or without ice) directly to domestic consumers and typically possess the fish for a day. On average, retailers have sales volumes of 67 t and EGP 940,000 a year (41). However both these sources are slightly outdated, with data from 2011.

There are two main types of farmed fish retailers in Egypt. The first group engages in 'informal' street sales, which are usually conducted by individual operators who purchase fish from wholesale markets or traders and then set up shop by the roadside to sell their product. The second group is more formalised, with sales completed from their retail shop (41).

Sales volume varies substantially between the different types of fish traders and retailers.

Table: 2 Sales volumes for fish traders and retailers across governorates (in t/yr). Source: (Nasr-Allah, A., et al., 2020)

	Beheira	**Fayoum**	**Kafr ElSheikh**	**Sharkia**	**Average**
Middle traders	5,355	468	459	-	1,549
Wholesalers	1,275	400	442	901	715
Fish shops	50	26	70	20	52
Fish markets	16	16	56	21	37
Street vendors	12	13	30	20	23
Live fish traders/transporters	9	18	32	16	22

Some products may pass through wholesale markets, while others are transported directly by traders/wholesalers to retailers. Much of the larger size-grade of tilapia (>350 g, known locally as 'super') is sold through the wholesale markets in Kafr el Sheikh, Behera and at Al-Obour, close to Cairo. Smaller fish will usually bypass these market establishments and be sold closer to farms. This is because the local population's purchasing power is weaker; therefore, there is a greater demand for smaller and cheaper fish (40).

Fish processing is a relatively underdeveloped phase in the value chain. Most fish are sold in whole form (live, fresh on ice, or fresh without ice). At the wholesale/trading stage of the value chain, products are rarely mass-frozen. As a result, minimal value is added through primary processing into fillets or other secondary processed products (e.g., ready meals, etc.).

Surprisingly, Egypt is still a net importer of fish and fishery products. Most imports (70%) are frozen fish products, mainly small pelagics such as mackerel, herring, and other marine fish. Fishmeal represents about 20% of imports; the remaining 10% comprises canned tuna, sardines, and fresh or chilled fish products. The Netherlands is the most crucial supplier of Egyptian fishery imports, followed by Norway and the UK (42).

Egypt has been unable to export fishery products to the European Union for the last few decades due to the lack of compliance with the requirements of European Council Directive

91/493/ EEC, in respect of "Health conditions for the production and placing on the market of fishery products". However, as of December 2024, this restriction will soon be lifted.

Institutional and legal framework

The Egyptian fisheries and aquaculture sectors are regulated by Law 124 of 1983. The only branch of government permitted to draft fisheries and aquaculture legislation in Egypt is the General Authority for Fish Resources Development (GAFRD), which was renamed in 2021 to the Lakes and Fish Resources Protection and Development Agency (LFRPDA). The Agency is also the only entity that can renew or issue new licenses: (i) licences for fishing vessels, (ii) licences for fishing, and (iii) leases for land-holding aquaculture farms.

LFRPDA oversees the nation's fisheries and aquaculture operations through seven regional offices. The Agency operates three branches in the primary fish production areas to enforce regulations determined by the central office. Each branch has a pilot farm, hatchery and soil and water analysis laboratories. These regional authorities are responsible for publishing information relevant to fish farmers, delivering free aquaculture training, and selling fish fry to private farmers. In addition, the Agency provides technical support to private farms whenever needed.

All fish farms, whether leased or owned by the operator, should be licensed by the LFRPDA. However, in practice, many fish farms operate without a licence due to the complexity of the application process, the number of agencies involved, and the governmental rules surrounding the layout of fish farms. Although fish farms are allowed to operate even if they are not licensed, they 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 (43).

Aquaculture leases are usually granted for a limited period, which can be as short as three years but is usually five years. These leases can be renewed multiple times for up to 25 years. A lease condition is that the fish farmer must increase production through new technologies (Ministerial Decree No. 1132, 2007).

In recent years, the role of the LFRPDA in the fish production sector has shrunk. In 2015, the Ministry of Agriculture and Land Reclamation budget, which operates under the Ministry, also faced budget cuts (44). Since that decision, the budget allocated for the management body has continued to decrease (45), and the national fund that supported its activities in 2016 (46) has been cancelled. These cuts led to a significant decline in fish production levels amongst the Agency's farms and generally hindered the government's contribution to developing the nation's fish farming sector.

GAFRD was renamed LFRPDA through a draft law on the protection and development of lakes and fish resources submitted by the Egyptian government to the House of

Representatives in August 2019. The law passed in 2021, and, according to the submitted project (as stipulated in Article 2 of Law No. 146 of 2021), a new agency was to be established which would report directly to the Prime Minister. This agency would (i) be responsible for regulating the exploitation of fishing areas in all their formats; (ii) work to maintain and develop fishing and fish farming areas; (iii) maintain the inlets and outlets in water bodies; and (iV) develop plans to implement the governorates' needs for fish farming projects.

Coinciding with the declining role of the General Authority, the National Company for Fisheries and Aquaculture, a subsidiary of the National Service Projects Organization (owned by the Ministry of Defence), was established in 2015 (47). The government has launched several projects in recent years through the new National Company, reallocating extensive swathes of state-owned land to be used for fish farming projects (48) (490 acres in the Ain Sokhna part of Suez (49); 2815 acres in the Ghalioun part of Kafr El-Sheikh (50) to add to the existing Ghalioun Lake project and one million acres (51) in the area of Toshka situated in the New Valley).

Given the National Company's vastly reduced production costs (the Army owns the land used for the farms as well as the factories that produce feed specifically for it), and enjoys exemption from corporate income tax (Article 47 of the Income Tax Law) and value-added tax (Article 28 of the Value-Added Tax Law), they can sell aquatic-derived foods at much lower prices than private sector farms. Many retailers and consumers prefer to buy from the National Company because of their lower prices, and many smaller fish farmers have been crowded out of the market (52).

Other institutions who deal with fishery issues in Egypt include the Co-operative Union of Aquatic Resources, the National Institute for Oceanography and Fisheries (NIOF), the Egyptian Coast Guard, and the Ministry of the Environment. However, although there are many overlaps between the two sectors, these institutions do not extend to aquaculture.

The main articles related to aquaculture in Law 124 specify the type of water and land used. Hatcheries are the only aquaculture units permitted to be the first freshwater users. Fish farms can only use non-agricultural land and can only farm in brackish water. The Law prohibits gathering, possessing or transferring fish fry from any water body without the written consent of the Authority/Agency.

Certification schemes

As of 2017, 50 Egyptian tilapia farmers were certified under the Best Management Practices (BMP) scheme (53). This scheme was developed by adapting Global G.A.P. and Aquaculture Stewardship Council standards in collaboration with the global food security-oriented non-governmental organisation WorldFish to local Egyptian tilapia farming conditions.

WorldFish research in Egypt suggests these best practice methods promote efficiency and sustainability, which leads to lower on-farm costs, reduced fish mortality and higher profitability. While there is currently no mention of welfare requirements under the BMP scheme, some requirements can still affect welfare (such as biosecurity rules), and it could be valuable to work with the BMP scheme in the future to introduce welfare requirements into their standard.

TOP CAMPAIGN OPPORTUNITIES

Water quality for farmed fish

This raises concerns about improving water quality for fish produced under aquaculture conditions. Poor water quality can cause chronic disease, reduced growth, and increased mortality, directly affecting profitability. Improving water quality would entail promoting monitoring equipment for water parameters such as dissolved oxygen, pH, and ammonia levels. This ask aims to ensure optimal fish health and well-being, mainly by minimising stress and disease outbreaks.

However, implementation of this task may be complex as pond water quality typically fluctuates considerably throughout any given 24-hour period. Usually, dissolved oxygen is at its lowest overnight due to respiration by fish and aquatic organisms and the absence of photosynthesis (54). Others also influence each water quality parameter; for example, dissolved oxygen levels are affected by temperature and salinity, and the extent of ammonia or nitrate toxicity is affected by water pH. Farmers or other relevant stakeholders need to understand how these elements interact to maintain adequate water quality and rectify related problems when they arise.

Mass mortalities and morbidities in many Egyptian tilapia farms have been attributed to bacterial diseases and increased water temperature during the summer (55). Epidemiological surveys carried out in 2015 indicated that 37% of fish farms in the three most crucial Egyptian aquaculture governorates, namely Kafr El Sheikh, Beheira and Sharqia, were affected with 'summer mortality syndrome' with an average mortality rate of 9.2% (56). Most farmers attributed those mortalities to deteriorating water quality and increased water temperatures during the summer months. Salinity typically increases during the hotter months due to the higher evaporation rate and subsequent reduction in oxygen solubility in water (57). Regular monitoring and better management practices are ways to avert these problems.

Issues of water quality and stocking densities are related. Water quality factors would directly affect the maximum density, consistent with good health and welfare. One of these factors is the flow rate of incoming water, which influences oxygen, carbon dioxide, and ammonia levels. The water flow must be administered according to the species' needs and stocking

density. However, we recognise that incoming water in Egyptian pond farming is often of no better quality and is, in fact, frequently poorer than that which is currently in the fish ponds.

In Egypt, where water scarcity remains a critical concern, in-pond raceway systems and RAS (Recirculating Aquaculture Systems) are slowly appearing in fish farming. RAS and raceways are land-based fish production systems in which water from the rearing tanks is reused after mechanical and biological purification to reduce water and energy consumption. These systems reduce the reliance on incoming water in aquaculture. Multiple water quality management techniques exist for closed-system aquaculture, such as filtration, aeration, real-time monitoring systems and carbon dioxide removal. These would be feasible to implement in concrete ponds, tanks and greenhouse culture systems. As intensive systems slowly pick up steam, it will be essential to consider welfare implications when drawing up plans for new production facilities.

Since farming in earthen ponds accounts for over 85% of total production, it makes the most sense to focus on pond systems first. For these farms, specific pond management practices should be implemented. These include pond preparation and treatment (including disinfection or adding lime), controlled water exchange, avoiding overfeeding through proper feed management and exploring the adoption of biofloc technology where possible to help increase the uptake of excess nitrogen (among other nutrients). More research is needed to determine whether measures such as maintaining a minimum water depth, ensuring the drainage canal is built well from the start, and constructing different variations of pond outlets could improve fish welfare.

Although we remain uncertain about the best way to implement this request, one hopeful option is to work cooperatively with farmers and monitor their water quality, similar to the Fish Welfare Initiative in India. Alternatively, the joint ESR-FAI Tilapia Welfare Project is already making headway in Egypt. It is rolling out FAI's Tilapia Welfare App to farmers to assess fish welfare in their ponds with a less hands-on approach. Figuring out the best strategy will likely take some trial and error.

Banning the sale of live chickens to consumers

In Egypt, between 64 and 70% of chicken is sold live, and the remaining 30% is sold frozen (3,4)(sources are from 2017 and 2003, respectively). This is driven by consumers' strong preference for fresh, live birds that are slaughtered immediately at sale and a lack of infrastructure for slaughtering and freezing chickens in Egypt (58).

In many cases, during market slaughter, the bird's throat will be cut, and then they will immediately begin plucking the bird's feathers before the bird has bled out. Given the large number of birds sold in this manner (about 896 million of the total 1.4 billion broiler

chickens) and the severity of the experience, the total potential suffering represented by this practice is likely to be quite high. This is despite its relatively short duration compared to other welfare improvements that can be introduced for broilers. On average, it is uncertain how long broilers spend in these live markets. Some estimates suggest it tends to be a matter of hours, whereas others suggest they usually spend several days in cramped cages before slaughter. Similarly, the prevalence of live plucking during slaughter is not apparent. If sale at live markets is banned, slaughter must occur at a licensed slaughterhouse. In which case, birds would still be slaughtered using a knife in the traditional halal manner as they are currently, but would avoid the prolonged caging and potential live plucking. The issue of concentrated slaughter in slaughter facilities needs to be addressed, which could be addressed later by implementing improved practices.

However, we remain uncertain about the average duration broilers spend in these live markets, whether it is several hours, if they are sold quickly, or potentially several days spent in cramped cages before slaughter. As well as the frequency of particularly horrific practices such as live plucking during slaughter. If banned, slaughter would have to take place at a licensed slaughterhouse. The birds would still currently be slaughtered using a knife in a traditional halal manner. Still, they would avoid prolonged cageing, potential live-plucking, and concentrated slaughter in facilities, which could be implemented practices.

Banning the sale of live birds comes with numerous benefits to producers (through a streamlined process and a shorter value chain), to the public (through reduced risks to public health), and to the birds themselves (through reduced handling and transport). Live bird markets have facilitated the spread of avian influenza, which has become a problematic endemic disease in Egypt (59). The spread of disease can wipe out entire flocks of birds, with mortality rates often around 50% (60). The direct deaths of thousands of birds cause devastating economic losses for producers and market retailers. Moreover, the spread of disease from farmed to wild birds can impact endangered species (61). In live markets, repeated exposure to disease vectors nearby risks transmission to humans, representing a global public health concern. During the avian influenza outbreak between 2006 and 2017, around 350 people were infected, of which almost 120 people died. Over 40 million birds were killed during this time to curb the spread of avian flu (62).

Attempts to curb the spread of bird flu in Egypt resulted in the passing of a 2009 law (63) banning the licensed selling of live poultry (64). However, the law was only implemented for two years until it was unofficially suspended during the January 25 uprising 2011 (65). As of 2013, more than 2000 live bird markets were operating in Egypt (59).

There have been subsequent motions from the Egyptian Ministry of Agriculture in 2018 to implement the law prohibiting live bird sales in the Cairo and Giza governorates. These two governorates consume around 30 per cent of the country's chicken (66). The idea behind the motions was that this would be the first stage before expanding enforcement to Lower and Upper Egypt) (67). Although this was initially reported as beginning in May 2018, it was later pushed to April 2019 and put on hold indefinitely. Live bird sales are still permitted as of the time of writing (68)(69).

There are still open questions about the effectiveness of the measures to ban live sales of birds destined for human consumption and to what extent they have been implemented. A 2021 report from the World Organisation for Animal Health on avian influenza in Egypt outlines similar figures for live bird markets between 2017 and 2021, suggesting the situation has remained unchanged (70).

Remaining uncertainties:

- Egypt currently only has the infrastructure to slaughter and freeze approximately 30% of the birds processed. Implementing this would require improving supply lines to accommodate refrigeration.
- Without further engagement with the responsible Egyptian authorities (i.e., the Ministry of Agriculture), it is hard to establish what action has been taken on the issue of live sales and how plans are likely to develop. This may mean this ask is particularly tractable as it lies at the intersection of the various problems (i.e., concerns about public health, animal health and animal welfare) and may only require some minor pressure on the relevant body to follow through on previous agreements. However, advocates who pursue this intervention should be prepared for the eventuality that this issue might be dropped again for one of many reasons that may be challenging to resolve.
- Given the dispersed nature of live bird markets, practices, such as live plucking, are still unclear despite the considerable welfare implications.

Quality control standards for domestic fish feed mills

This question relates to improving the quality and nutritional value of pellet fish feed and methods used to produce fish feed, which leads to less waste. The current, global, gold standard method for fish feed production extrusion to create pellets. Extrusion produces floating pellets that manage feeding quantities and regimes, reducing feed waste and the associated deterioration in water quality. This ask can potentially increase fish welfare in multiple welfare domains, namely nutrition and environment (through water quality improvements).

Under farming conditions, fish are provided artificial diets and sometimes face inadequate feeding conditions, which may result in increased stress, altered behavioural patterns, and, thus, slower growth. The nutritional composition of feed plays a vital role in maintaining optimal health and welfare for fish in aquaculture. Adequate nutrition is essential to avoid deficiencies, sustain normal health and promote optimal growth (71)(72). Fish immune systems can be supported through dietary nutrients and additives, such as vitamins C and E, fatty acids, and yeast-derived products (73). However, the digestibility and palatability of formulated feeds are other critical factors influencing fish feed intake and nutrient uptake.

Extruded fish feed pellets have been found to improve water quality significantly. In particular, studies have shown that smaller particles with higher moisture content produce more durable and stable pellets which float better in water (74). Generally, floating feed has advantages over sinking feed since it is more stable in water and more easily digested by fish, leading to less feed waste (75,76). Various studies on the effect of feed types on fish performance have reported that tilapia-fed floating feed grew faster than those fed sinking feed (77,78).

Egypt's domestic fish feed industry has recently seen significant local and foreign investment, especially in aquafeed extrusion technology. However, producing floating pellets requires high temperatures and pressure, among other costs, making them more expensive than their traditional sinking counterparts. However, over 70% of Egyptian semi-intensive pond tilapia farmers are estimated to use extruded pellets (6).

In Egypt, 33% of fish feed mills are small-scale, and outdated equipment is still standard. Small-scale feed manufacturers also tend to produce feeders of nutritional and structural quality (5).

Feed constitutes the majority of fish farms' operating costs (70–95%) (7), so farmers are vested in sourcing optimum feeds that can lower their feed conversion ratio. The Egyptian feed sector is highly competitive and features many medium-scale (42.6%) and small-scale (33.3%) enterprises.

Egypt has around 100 privately owned feed mills, concentrated in seven governorates, that provide the country's fish feed. These include sizeable multinational fish feed companies that have established large factories in Egypt and partnerships between domestic and multinational companies. The more prominent feed manufacturers tend to uphold higher production levels and have better quality control standards.

Over time, the feed sector is expected to experience consolidation, leaving fewer companies due to smaller operations being bought out by larger ones or simply shutting down due to financial pressures, competition, and a complex economic backdrop (5).

The fish feed industry receives relatively little regulatory oversight, such as product testing or certification. However, some larger companies have secured certificates from the International Organization for Standardization (ISO).

Remaining uncertainties:

- What kind of quality control standard is feasible to implement? The Aquaculture Stewardship Council Feed Standard would be out of reach for many feed manufacturers.
- How can the nutritional value and structural composition of fish feed be improved from a welfare perspective while still being affordable for farmers, given that rising feed costs are one of the most commonly cited concerns (40)?

OTHER ALMOST STRONG CAMPAIGNS

Although the following campaigns could be potentially impactful, they come with increased uncertainty vis-à-vis the top four priority asks listed above. Further development or investigation would be needed to confirm their potential.

Lobby for policy change to allow the aquaculture sector to use 'fresh' water directly from the Nile and not rely solely on the use of post-industrial and agricultural drainage water

This request would involve lobbying the government and/or supporting existing government initiatives to reconstruct the country's water use hierarchy.

Agricultural drainage water affects fish farms' physical, chemical, and biological characteristics, leading to lower water quality levels and the accumulating of heavy metals and pesticide residues in fish (79). This is one of the reasons large importers such as the European Union and the neighbouring Gulf countries have placed tight restrictions on the species of fish that can be imported from Egypt. However, this incentivises the government to reform the current hierarchy of permitted water use (80). Alternatively, water treatment could be introduced to remove potential toxins from the water entering fish farms (81).

Remaining uncertainties:

- Despite proof that the Egyptian authorities are interested in (and working towards) improving water quality and other environmental aspects in the northern lakes, the extent to which this can be translated into reconstructing the hierarchy of water drainage systems as they pertain to aquaculture activities is unclear.

- A campaign to change rules around national water usage might not be the best campaign for an animal advocacy organisation. An environmental or public health organisation would be better positioned to work on this issue.

- The government already has a strong incentive to solve the issue of national water usage and correct hierarchies among the various users, even without considering the implications for animal welfare. Allocating marginal resources towards lobbying the government or finding other solutions might be less valuable, as there are likely different reasons why this problem has not yet been solved.

Lobby for the creation of a specific government body responsible for animal welfare to adhere to WOAH's standards

The current protections conferred by Egyptian legislation on animals are entirely inadequate. Egypt has no dedicated national animal welfare legislation or government body responsible for animal welfare. The Ministry of Agriculture and Land Reclamation is responsible for animal health; however, no government ministry has been assigned overall responsibility for animal welfare. Although Egypt is a member of the World Organisation for Animal Health (WOAH), it has not complied with the welfare standards set by the organisation so far.

This ask would include implementing an initiative at the state level to consolidate the work of existing animal welfare groups in Egypt into an Animal Welfare Committee responsible for the country's overall animal welfare issues. The Committee, under either the Ministry of Agriculture and Land Reclamation or the Ministry of Environment, would then be responsible for introducing an Animal Welfare Act that includes a definition of animal welfare in line with the WOAH guidelines and explicitly promotes the 'Five Domains'.

World Animal Protection's analysis of Egyptian policy highlights that "the existing legislation provides a framework to build processes for assigning responsibility and accountability for improving animal protection in the country" (8). The Ministry of Agriculture and Land Reclamation in Egypt has some responsibility for developing secondary legislation for animals. However, these are focused on animal health rather than animal welfare. This work is done through the General Organisation for Veterinary Services (GOVS), a body associated with the Ministry of Agriculture and Land Reclamation, which has the mission to "protect animals from infectious and epidemic diseases" (8).

The concept of government agencies or departments responsible for animal welfare at various levels of government is in practice elsewhere in the world. These agencies often collaborate with non-governmental organisations (NGOs), veterinarians, researchers, and other stakeholders to develop and implement policies and programs related to animal welfare.

In Egypt, laws relating to animal welfare and animal protection in general do not seem to be a priority in policy. Socio-cultural attitudes toward animals in the country may present barriers to progress because the public does not regard animal welfare as an issue. However, animal protection organisations in the country can directly engage in advocacy to influence the government to implement WOAH standards and support the development of a national animal welfare committee by adhering to WOAH standards.

- This work is necessary for the future and more comprehensive reforms in Egypt. The creation of an Animal Welfare Act, in particular, would make future legislative work possible, which could then be added to the Act or added as secondary legislation subordinate to the Act. However, the creation of the first Animal Welfare Act may be a problematic lobbying campaign, given the Egyptian government's lack of animal welfare legislation to date. We, therefore, think that while this is something Egyptian animal welfare organisations should aim for and position for in the long run, it might be wiser to start with campaigns with a higher chance of success.

Optimal stocking densities in fish farms

This ask involves establishing guidelines and regulations on appropriate stocking densities for different fish species farmed in Egypt and working with farmers to implement those changes. It would additionally involve educating farmers on the importance of maintaining appropriate stocking densities for optimum fish welfare and growth. The aim is to ideally maintain stocking densities at levels that do not compromise fish social behaviour or psychological conditions. This would increase fish welfare and farm productivity through improved water quality, minimised stress, and reduced disease transmission, ultimately decreasing mortality rates.

Stocking density has been reported to affect fish survival, growth, health, and yield, mainly through effects on social interactions and water quality. Density affects fish welfare and, thus, the appropriate stocking density. This is due to significant interspecific variations in behavioural and physiological requirements.

For most farms, stocking density is seen as a production constraint that needs to be optimised. This means figuring out the species-specific stocking density for the farms must consider how economically viable it would be for the farmers to change tactics. Otherwise, farmers might not adopt the optimum stocking density. Stocking density standards must also be paired with other measures, like water quality improvements, to ensure fish welfare. Biofloc technology is used to improve water quality in some semi-intensive tilapia farms.

Remaining uncertainties:

- The current stocking densities in most farms are not accurately recorded.

- No guidelines exist for optimal stocking densities for the species farmed and production systems presently used in Egypt. Determining the optimal stocking density for a specific species or farming system involves considering factors such as water quality, growth performance, and fish behaviour. The physical space available for the fish, including the size and design of the tanks or ponds and the system's carrying capacity, should also be considered when determining stocking density. Species-specific guidelines must be developed before reaching out to farmers or policymakers.

Promote the use of Indigenous slower-growing broiler breeds.

This ask constitutes shifting poultry production to slower-growing broiler breeds (such as 'balady') to reduce the prevalence of fast-growing breeds. Slower-growing breeds have better welfare outcomes, including lower mortality and incidences of footpad lesions and hock. Small-scale broiler producers in Egypt (less than 15,000 broilers per cycle) have a typical production cycle of 40 to 45 days with an average feed conversion rate of 1: > 2.1 (more than 2.1kg of feed for each kg of live weight of the bird), and an average live weight at slaughter of 1.8 kg (29).

The rural broiler sector in the Sharkia and Qalyubia governorates is semi-intensive and uses commercial strains, including Cobb, Habared, and Ross broilers. The market age was 42 days, with an average final body weight of 2.5 kg (82). In the Qalyubia and Menoufia governorates, day-old chicks are fattened over a production cycle of 35 to 40 days until they reach a slaughter weight of around 2.1 kg (29).

Generally, the food conversion ratio for native breeds (1:3) is higher than that for exotic modern broiler strains (1:1.8). The time it takes for the native breeds to reach the market weight (60 to 80 days) is almost double the time required for the exotic strains to reach the market (35 to 42 days) (83). These factors should cause resistance and push farmers to shift production to native breeds.

Positive perceptions about the consumption of slower-growing breeds already exist. The meat and eggs produced by native and improved native breeds are considered niche products sold at a premium price. They are preferred to those made by exotic hybrids for several reasons, the foremost being the degree of meat maturity, taste, texture, and intense flavours. The widely held belief that female hormones and contraception pills are used in commercial poultry production has resulted in consumers preferring the local native chicken meat and eggs (83).

Al Azzab (built-in 1983) is a national genetic bank for local, purebred poultry breeds. It provides the rural backyard sector with birds such as the Fayoumi breed, which could be a valuable resource for transitioning toward slower breeds.

Remaining uncertainties:

- Transitioning to slower-growing breeds will be difficult because of the more significant costs associated with higher conversion ratios and slower growth rates. Since feed costs amount to most production costs, this could multiply total production costs several times. While we think this would be worthwhile regarding animal welfare benefits, it would be a difficult sell that is not sensitive to the cultural or socio-economic local context.
- While it is reasonable to conclude that slower-growing Egyptian breeds, better adapted to the local climate, will have superior welfare outcomes to modern fostering breeds, the necessary scientific evidence to prove this theory has not yet been established.

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