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FISH FARMERS IN THE NILE RIVER DELTA: EMPTY LAKES AND DIRTY WATERS

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This article is the first in a series exploring how climate change is impacting vulnerable and marginalized groups and their livelihoods in societies across the Middle East and North Africa. The series analyses how climate and human factors interact to put pressure on different societal groups, and it discusses strategies and prospects for successful climate adaptation and resilience-building measures.

Introduction

Egypt has a long tradition of fisheries. Fishing and fish farming along the Nile River, in its adjacent lakes, and along the coast of the Mediterranean Sea has been a common practice for millennia and remains a major source of food for many Egyptians. On paper, the fisheries sector in 2023 is healthier than ever before, with a significant recent increase in aquaculture activities (e.g., fish farms) in Egypt's fertile Nile River Delta. Nevertheless, local fish farmers are facing mounting pressures: Year after year, their fish are getting smaller and less healthy, their production decreases, and they are forced to take out loans they are later unable to pay back. The people who for generations have worked a job that represents an important economic and cultural value for Egypt today suffer from a combination of climate-related and man-made stresses. This not only poses a serious threat to their own livelihoods but also imperils Egypt's overall water, food, and economic security. The Egyptian government's recent efforts to invest heavily in aquaculture, though intended to address future food shortages, may only worsen the position of local fish farmers in the Delta.

Pressures on Delta fish farmers

Long-standing problems in the Delta

The Nile River Delta is a fertile region that stretches 240 kilometers (150 miles) along the Mediterranean coast of northern Egypt and covers [22,000 sq km](#). And though this only represents between 2% and 3% of Egypt's total area, the Delta is [home to around 40%](#) of the country's 107 million inhabitants and is central to its economy. The fisheries, aquaculture, agriculture, and tourism sectors in the Delta contribute to [20% of Egypt's GDP](#).

As a relatively small region with an outsized economic importance, the Delta has become very crowded in recent decades, leading to significant competition over land use between the agricultural, fisheries, and urban development sectors. The Egyptian authorities have generally prioritized the latter, and the consequent rapid urbanization has gradually compelled fishermen to turn to fish farming in legally restricted areas.

In addition to intensifying competition over land, urbanization in the Nile Delta has worsened Egypt's water quality. [Years of lax and inadequate government regulation](#) around the dumping of industrial waste, toxic chemicals, and sewage water, together with sharp increases in household and industrial waste due to urban expansion, have [heavily polluted](#) most of the water flowing through the Delta's 53,000 km of irrigation canals. This water is dangerous for the health of local people,

animals, and plants, and it directly affects fisheries. The contaminated water that infiltrates fish farms impacts the health and quality of the fish; infects them with viral, bacterial, and fungal diseases; and, indirectly, introduces [dangerous heavy metals](#) into fish stocks that far exceed healthy limits for humans. As a means of managing water shortages in the Delta, the Egyptian government decided in the 1990s that the relatively cleaner irrigation water from the Nile may only be used for agriculture. This leaves fish farmers with [no choice but to use highly polluted water](#) from drainage canals.

Most fish farms in Egypt are located along the northern edge of the Nile River Delta, centered around four lakes adjacent to the coast — Manzala, Edko, Borul, and Mariut. The largest and, until recently, most productive is Lake Manzala, in the northeast; but [98%](#) of its water stems from highly polluted drainage canals. The fish from Lake Manzala are unfit for human consumption and pose a risk to the health of local fish farmers, who systematically

suffer from waterborne diseases such as typhoid, cholera, and giardiasis. It is not surprising, then, that many countries, notably from the European Union, have put tight restrictions on the types of fish they buy from Egypt. [Mass fish deaths](#) in these lakes are becoming commonplace. Fish farmers in certain areas have found that their average fish production has [significantly decreased](#) over recent decades, in part because their fish are dying before being fully grown. As a consequence, the total volume of fish produced by smallholder fish farms in the wider northeastern region of the Delta has remained about the same over the past seven years (around [1.7 million tons](#)), despite the [number of fish grown on each farm having tripled](#). In an attempt to halt Lake Manzala's deterioration, between 2017 and 2022 the Egyptian government coordinated a large-scale campaign to rehabilitate the lake and began constructing wastewater treatment facilities in the area — although [its impact on water quality is inconclusive at this point](#).



Map above: Main lakes of the northern Nile River Delta. Map created by MEI using cartographic data courtesy of [d-maps.com](#).

Climate change as a new challenge

Beyond local challenges of pollution and urbanization, climate change is adding more urgency to the already fragile position of Nile Delta fish farmers. The Mediterranean is one of the most vulnerable regions to climate change, with temperatures in the eastern portion of this sea and the neighboring Middle East rising [twice as fast as the global average](#). These effects also extend to the Nile River Delta. The combination of sea level rise, coastal erosion, and seismic motion is causing the Delta to sink by one centimeter each year. Since a quarter of the Delta is situated only one meter above sea level, many parts risk being wholly submerged [by the end of this century](#). The rise in sea level, paired with increasingly intense floods, threatens major coastal Egyptian cities like Alexandria and its 6 million inhabitants. It also poses a major threat to fish farms, which are overwhelmingly located in the low-lying, northern part of the Nile Delta. While [current engineering efforts](#) might slow sea level rise, it is very unlikely they can entirely prevent important parts of the Delta from being submerged in the coming decades.

The Egyptian government has consciously invested in aquaculture since the 1980s. Paradoxically, this might make the sector more vulnerable as the effects of climate change grow worse. In 1987, around 492 sq km (2.2% of the Delta's total area) was allocated to fish farming. In 2015, this area [nearly tripled](#) to 1,312 sq km (6% of the Delta). Aquaculture basins tend to only be around 1.5 meters deep, and the rise in temperatures due to climate change very quickly heats up these shallow areas, destabilizes their chemistry, and leads to the spread of diseases. Most types of fish are not able to survive in these warming waters, which have also become saltier and dirtier. Fish farmers in the Delta, therefore, have already resorted to breeding mostly mullet and tilapia, which are more resistant to pollution, temperature increases, and heightened salinity levels.

In the meantime, coastal erosion is also deteriorating the Delta's fragile ecosystems. Human activity and urbanization all along the Nile, as well as the clogging of Delta canals due to waste, is preventing river sediment from reaching the coast and acting as a natural defense against sea intrusion. Nowadays, [only around 10%](#) of the Nile's water reaches the Mediterranean. As a result of rising sea levels and exacerbated by expanding urban development, salty seawater

has reached into the Delta's soils and freshwater lakes and altered local ecosystems. The lack of natural sedimentation, together with an increase in soil salinity and water pollution, has severely affected the health and fertility of the soil, causing a drop in crop yields. In order to maintain terrestrial agricultural production, farmers have expanded their use of (increasingly expensive) pesticides, fertilizers, and salt-suppressing chemicals on their land, further degrading the soil. These chemicals also end up in drainage water, which then accumulates in fish farm lakes.

Future pressures from upstream

The dynamics in the Delta demonstrate how the intersection of climate change and human influence affects entire ecosystems as well as economic sectors. Although it is home to the world's second-largest river, Egypt is already experiencing water scarcity, with slightly over 500 cubic meters of annual freshwater available per person — about half as much as the [minimum necessary to meet basic human needs](#), according to the United Nations. As the population continues to grow, the increased demand for water will further destabilize the situation.

But Egypt is not alone in using the Nile: It shares it with 10 other African countries upstream. The progressively hotter and drier seasons in East Africa are already reducing the river's volume. As a downstream country dependent on the Nile for [95%](#) of its water needs, Egypt is highly vulnerable to any changes to its water supply. Notably, in 2011, its upstream neighbor Ethiopia, located on the Blue Nile (which feeds [86%](#) of the Nile's water supply), unilaterally decided to begin building the Grand Ethiopian Renaissance Dam (GERD). When completed, the GERD will hold back [74 billion cubic meters of water](#) — equivalent to Egypt and Sudan's combined annual share. Cairo, Khartoum, and Addis Ababa have, thus, been locked in an ongoing diplomatic dispute over the dam since the start of construction. Ethiopia [started to fill the GERD reservoir](#) in July 2020 and has two turbines running today; it expects the GERD to be fully operational in another 2-4 years.

Ethiopia considers the dam to be of crucial importance to develop its economy; but to Egypt, it is potentially disastrous. Besides threatening its water security, the GERD will trap much of the Blue Nile's agriculturally productive sediment, further preventing it from reaching the Nile River Delta and



Photo above: Street vendor selling fish in Alexandria, Egypt, November 2019. [Photo by Frédéric Soltan/Corbis via Getty Images.](#)

contributing to its growing infertility. The expected decrease in water from the Nile will also lower groundwater levels in Egypt, enabling even more seawater to flow into the Delta and further increasing pollution in its canals. A study published by the Egyptian Institute of National Planning suggests that the GERD will devastate or entirely annihilate the populations of [12 fish species](#) living in the Nile River, connected lakes, and local fish farms. Even tilapia, which makes up [over 60% of Egypt's total fish production](#) and is considered one of Egypt's most resistant fish species, will be affected.

Coping with vulnerability

As the various challenges around population growth, urbanization, climate change, and regional Nile politics worsen in the coming decades, so too will the pressure on Egypt's crucial fisheries sector, and, by extension, its food, water, and economic security.

Since 2016, Egypt has significantly ramped up its investments in aquaculture by opening multiple fish farm mega-projects,

each costing several hundred million dollars. The biggest to date, the al-Fayrouz Fish Farming Project, was inaugurated in 2021. Producing over 1 million tons of fish annually, it is now the [largest aquaculture project in the Middle East and Africa](#). Between 2016 and 2020 alone, and primarily due to the fish farm mega-projects, Egypt's total fish production rose [by nearly 18%](#), reaching 1.62 million metric tons. At the end of 2021, the Egyptian government announced that it had reached its objective of being practically [self-sufficient in fish production](#). Only four years earlier, [40% of its 2.4 million tons](#) of fish consumed annually still had to be imported. By 2019, Egyptian aquaculture was a [\\$3.2 billion industry](#), and it has only continued to grow since then. Egypt is hoping that these investments will decrease imports, increase exports, and boost its struggling economy, which is coping with [crushing inflation and a foreign currency shortage](#). Last December, the International Monetary Fund (IMF) granted Egypt a [\\$3 billion loan](#) — the country's fourth loan in six years.

The story is not as optimistic for Delta fish farmers, however, whose smaller fish farms are being outcompeted by

these government-run mega-projects. When the Egyptian government created its state- and military-owned National Company for Fishery and Aquaculture in 2015 to run the new fish farm mega-projects, it actively sought to reduce the power of Egypt's existing fish production regulator, the General Authority for Fish Resources Development. The government reduced the General Authority's budget from 128 million to 38 million Egyptian pounds (\$8 million to \$2.5 million), while expanding the power of the National Company for Fishery and Aquaculture. This severely affected the General Authority's capacity to support smallholder fish farms. The government also increased the rent tenfold for private fish farmers, who have systematically fallen into debt. Furthermore, state-owned farms enjoy [exclusive access](#) to cheap energy and are exempt from corporate income tax and value-added tax (VAT), which fish farmers argue [has driven down market prices by 30%](#).

Faced with rising rents and mounting debts, smallholder fish farmers are left with few options. Some are trying their luck in other fishing locations, and an increasing number of them are quitting the sector altogether. Some villages around the fishing town of Port Said, which provides jobs for both fishermen in the Mediterranean and fish farmers on Lake Manzala, [have seen their population halve](#) in the past decade.

Egypt is on a quest to ensure food security for its growing population, which is expected to reach 150 million by 2050, compared to 107 million today. But by pursuing this goal through nationally owned mega-projects that enjoy preferential treatment, Egypt runs the risk of alienating an important part of its working population and feeding into the existing state of discontent caused by the crumbling economy and generally soaring food prices. In addition, the current approach of significantly expanding intensive aquaculture in already polluted waters will continue to degrade the Delta's ecosystems. Intensive fish farming at such a massive scale requires the use of polluting veterinary drugs to counter diseases, and it produces high concentrations of waste, dead fish, and feces, which then end up in drainage canals. Over the past decade, the Egyptian government has put in place [a set of strategies, laws, and large-scale projects](#) to better manage its water resources — ranging from [cleaning up the Delta's lakes](#) to [rehabilitating and lining its canals](#). These efforts have been important, but they cannot keep up with the pace of environmental degradation and pollution produced by Egypt's

factories, urban centers, and, now, fish farm mega-projects — especially when taking into account the future decrease in the Nile River's flow.

By prioritizing economic and food security above all else, Egypt risks pursuing a course that is ultimately unsustainable. Instead, it should adopt a long-term vision that strikes a balance between its food, water, economic, and environmental priorities. Together, this policy mix would include:

1. Ensuring that economic and urban development plans systematically integrate climate adaptation measures. The Delta is already overcrowded and ecologically degraded, so any further development should be based on independent scientific assessments of the Delta and its inhabitants' and ecosystems' absorption capacity. On paper, the Egyptian government has committed to this in its recent [National Climate Strategy 2050](#), but it needs to turn these commitments into action. That also means the government should scale down its fish farm mega-projects, where possible: In their current form and size, they outcompete smallholder fish farmers, increase disease spread through the crowding together of masses of fish, and further degrade the Delta's heavily polluted water. While meeting Egypt's food security needs in the short term, the current intensive approach will only cause a quicker depletion of the Delta's resources, potentially hastening a dramatic point of no return for Egypt's food and water security in the long run.
2. Investing in the climate adaptation capacities of Nile River Delta fish farmers by both the Egyptian government and the international community. For the Egyptian government, this means reinvesting in smaller-scale, private, and sustainable fish farming through the General Authority for Fish Resources Development. The General Authority can assist aquaculturalists to better cope with the effects of climate change, for example by canceling debts, proposing social security and disaster insurance, and helping them transition to more sustainable fisheries practices and technologies. International funds like the United Nations' [Green Climate Fund \(GCF\)](#) or the new ["loss and damage" fund for vulnerable countries](#), introduced at the 2022 U.N. Climate Change Conference (27th Conference of the Parties, COP27), can help finance this targeted support to smallholder fish farmers.

3. Prioritizing efforts to achieve cleaner water in the Nile River Delta, a process which has several entry points. First, scaling up the government's ongoing (but limited) efforts to clean and improve existing irrigation and drainage canals. Second, heavily investing in wastewater treatment plants, which has the potential to increase water availability by [around 5%](#) under current conditions. Third, incentivizing Egyptians to reduce pollution of the Nile's waters. An Arab Barometer survey shows that [93% of Egyptians](#) consider the pollution of drinking water to be the biggest environmental challenge in the country. Awareness campaigns on the links between waste, health, water, food security, and climate change can help people understand their role in addressing these various problems. Fourth, investing in improved waste disposal in order to support behavioral change regarding domestic and industrial waste. Fifth, ensuring that the existing laws and penalties around the protection of lakes, fisheries, and beaches in the Delta are expanded and enforced. This route is essential for the health and livelihoods of fish farmers, as the Delta's high levels of pollution are contributing to

dwindling fish catches and to diseases among fish, fish farmers, and consumers.

4. Anticipating water issues upstream before they become critical. Egypt and the other Nile countries need to pursue multilateral cooperation to address their current and future water needs. Beyond the GERD, issues around freshwater availability and allocation are going to intensify in the coming decades due to a combination of drier, hotter, and more inconsistent seasons caused by climate change, growing populations, and potential future dam building projects in the riparian countries. Reductions in water from the Nile will further destabilize the Delta's ecosystems due to higher concentrations of pollution and salt in its waters as well as threaten the already vulnerable fish species on which fish farmers in the Delta depend. Many of the Nile countries are set to face water challenges, be they floods or droughts, and they will not be able to address these issues alone. As the Nile's main downstream country, it is critically important for Egypt to keep multilateral dialogue on these issues open and cooperation constructive.



Photo above: The al-Fayrouz Fish Farming Project. Photo courtesy of Egypt's National Company for Fisheries and Aquaculture.

Conclusion

Fish farmers in Egypt's Nile River Delta face a slew of multidimensional challenges: They are situated in one of the world's worst climate change hotspots, their jobs are inherently vulnerable to climate stresses, and they have to operate in an increasingly inhospitable context that affects both their occupational security and health. This group represents an important piece of Egypt's societal and economic structure, and the fact that they are currently struggling reflects the vulnerability of the Delta's ecosystems as well as the need for a different approach. In its attempt to meet the rising food demands of its fast-growing population, Egypt has been prioritizing intensive food production over the long-

term environmental health of the Delta, on which this very food production depends. The current course of action is not sustainable for smallholder fish farmers or for Egypt's overall long-term socio-economic interests. Yet it is not too late to change course and better structure Egypt's economy to take into account the ecological health of the Nile River and its Delta.

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