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## The natural imperative for African aquaculture species and system diversification: Case studies from Ghana

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### Abstract

Aquaculture has been promoted over the last seven decades as a solution for persistent animal protein shortage in Africa. Over the same period, Africa has lagged well behind the world, especially Asia, in the growth of aquaculture. In recent decades, the causes of slow pace of aquaculture development in Africa have been recognised as a combination of emphasis on subsistence, a one-size-fits-all paradigm of development, and a lack of encouragement of local innovation. For example, two species: Nile tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gariepinus*) were widely promoted for aquaculture across the continent, with production primarily conducted in earthen ponds, whereas demand for specific fish products varies widely by region, country, ethnic, and social groups. On production systems, it is only a recent increased adoption of cage-based aquaculture that has significantly increased the contribution of aquaculture to national fish production in countries such as Ghana. This study makes the overarching case that 1) there are sustainable aquaculture systems that could be adopted at scale in Africa to increase aquaculture production, and 2) there are many native species that could be developed and cultured to diversify aquaculture systems and make them more resilient to environmental change. Results are presented here of a test of a pilot small-scale aquaponics system involving the production of African catfish and tomatoes in a closed nutrient cycle with minimal waste discharge. Six months of production resulted in an output 300 kg of catfish in a 4 cubic metre capacity concrete tank and 25 kg of tomatoes in a 1.5 square metre grow bed all in a 6-month production cycle. Additionally, results will be presented on captive breeding and feeding trials of two species native to Ghana and previously unknown in aquaculture— *Coptodon zillii* and *Coptodon discolor*, the latter of which is a species declining in capture fisheries. The success of breeding these species in captivity and raising them on existing tilapia feeds provides opportunities for species diversification. The major challenge facing adoption of recirculating aquaculture systems in Ghana is unreliable and expensive electricity. Development of solar energy technology for aquaculture in Africa is highly recommended.

**Keywords:** Aquaculture, aquaponics, food security, lesser-known species