OVERVIEW OF ORNAMENTAL FISH PRODUCTION IN KENYA: CURRENT STATUS, OPPORTUNITIES AND CHALLENGES

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Abstract

Kenyan ornamental fish industry is the fastest growing ornamental industry in Africa. It includes locally wild caught marine species and captive bred freshwater species. Presently, the industry contributes to the economy of the country by generating income through export earning, creating employment and enhancing livelihood of the fisher community and fish farmers. Marine ornamental fish industry in Kenya has an annual collection of approximately 300,000 pieces of fish of different species. The most collected fish are from the families Labridae, Pomacentridae, Serranidae, Blenniidae, Scorpaenidae, Pomacanthidae and Acanthuridae. Fresh water ornamental industry is still at its infancy and accounts only for 3% of fish under aquaculture. There are numerous unexploited wild species with great potential in the Kenyan fresh water bodies especially Lake Victoria and other small water bodies in the Lake Victoria Basin. The freshwater ornamental fish trade is dominated by the non-indigenous species comprising of Gold fish (*Carassius auratus*), Koi carps (*Cyprinus carpio*) and Mollies (*Poecilia spp.*). The demand of ornamental fish presents a considerable challenge to conservation and management of the industry as a result of unsustainable fishing practices which targets juvenile fish making them vulnerable to depletion. Wild collection of ornamental fish is also faced with numerous challenges including inadequate stock assessments, limited data on population structure, inefficient fisheries management measures as well as instances of illegal, unreported, and unregulated fishing. Address to these challenges can lead to success in sustainable management and exploitation of the industry for increased economic benefits.

Key words: Kenya, ornamental fish, opportunities, challenges

PERÇU DE LA PRODUCTION DE POISSONS ORNEMENTAUX AU KENYA : SITUATION ACTUELLE, POSSIBILITÉS ET DÉFIS

Résumé

L'industrie de poissons ornementaux au Kenya constitue l'industrie ornementale qui connaît la croissance la plus rapide en Afrique. Elle comprend les espèces marines sauvages capturées localement et les espèces d'eau douce élevées en captivité. À l'heure actuelle, l'industrie contribue à l'économie du pays en générant des revenus par l'exportation, en créant des emplois et en améliorant les sources de revenus des pêcheurs et des pisciculteurs. L'industrie des poissons marins ornementaux au Kenya peut se targuer d'avoir une collection annuelle d'environ 300 000 pièces de poissons d'espèces différentes. Les poissons les plus recueillis proviennent des familles Labridae, Pomacentridae, Serranidae, Blenniidae, Scorpaenidae, Pomacanthidae et Acanthuridae. L'industrie de poissons ornementaux d'eau douce en est encore à ses débuts et ne représente que 3% des poissons en aquaculture. Il existe de nombreuses espèces sauvages inexploitées ayant un grand potentiel dans les masses d'eau douce du Kenya, en particulier le lac Victoria et d'autres petits plans d'eau dans le bassin de ce lac. Le commerce du poisson ornemental d'eau douce est dominé par les espèces non indigènes comprenant les poissons dorés (*Carassius auratus*), les carpes de Koi (*Cyprinus carpio*) et les mollies (*Poecilia spp.*). La demande de poissons ornementaux pose un défi considérable à la préservation et à la gestion de l'industrie en raison des pratiques de pêche non durables

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qui ciblent les poissons juvéniles, les rendant ainsi vulnérables à l'épuisement. La collecte de poissons ornementaux est également confrontée à de nombreux défis, notamment l'évaluation insuffisante des stocks, l'insuffisance des données sur la structure des populations, l'inefficacité des mesures de gestion de la pêche ainsi que des cas de pêche illégale, non déclarée et non réglementée. La solution à ces défis peut engendrer la réussite dans la gestion et l'exploitation durables de l'industrie pour un accroissement des bénéfices économiques.

Mots-clés: Kenya, poissons ornementaux, opportunités, défis

Introduction

Ornamental fish industry is considered as one of the high value fish industry in the world trading at USD 200 to USD 330 million annually (Grey *et al.,* 2005; Dee *et al.,* 2014) with negligible quantities being traded compared to food fish (FAO, 2016). Kenya is among 45 source countries that supply the global trade with ornamental fish and is a major supplier among countries of the Western Indian Ocean region (Okemwa *et al.,* 2016). The Kenyan ornamental fisheries comprises of freshwater (mainly farmed) and marine (coral reef fishes collected from Indian Ocean). Despite the slow growth of the industry, it plays an important role in the country's economy through foreign exchange earnings. Freshwater ornamental fish culture is fast emerging as a major branch of aquaculture globally including Kenya and accounts only for 3% of fish under aquaculture in Kenya. The ornamental fish breeding, fry rearing and grow out are conducted by a few commercial farmers (SDF, 2013) and the marine aquarium fish market is controlled by 144 aquarium fishers and 8 aquarium exporters located at the Kenyan Coast (Okemwa *et al.,* 2016).

The expansion of this industry among the low income population is an important aspect of the economy of Kenya due to its ability to generate considerable income, with high export earnings, as well as its potential for raising the living standards among rural communities and providing employment opportunities for fish farmers and fish collectors (Okemwa *et al.,* 2009; SDF, 2013). The success of such an industry depends on the availability of appropriate resources, market information, local and international market demand, and an institutional framework within the country to favour sustainable growth of the sector and trade. Given the present status, it is important to analyze these various aspects in order to promote expansion of the industry. This study aims to assess the present status, challenges and future prospects in the ornamental fish industry in Kenya.

Current status of marine ornamental fish production

The marine ornamental trade in Kenya began in the late 1960s and has grown over the years. The diversity of species collected has risen from about 48 in 1980's to over 200 species (Okemwa *et al.,* 2009). Kenya ranks first among other countries within the Western Indian Ocean that include Mauritius, South Africa, Madagascar and Tanzania in marine ornamental fish trade (Okemwa *et al.,* 2016) with an annual collection of approximately 300,000 pieces of fish of different species. This represents a minimum of 235,000 pieces collected in 2007 and a maximum of 326,700 pieces collected in 2008 (Figure 1). There exists 250 species of fish from 35 families targeted for ornamental fish trade including Acanthuridae, Labridae, Serranidae, Blenniidae, Scorpaenidae, Pomacanthidae, Microdesmidae, Gobidae, and Chaetodontidae. The most harvested marine ornamental fishes include Labroides dimidiatus, Sea goldie (*Pseudanthias squamipinnis*), Fire goby (*Nemateleotris magnifica*), Sixline wrasse (*Pseudocheilinus hexataenia*) and Twobar anemonefish (*Amphiprion allardi*) (Okemwa *et al.,* 2009; Okemwa *et al.,* 2016). The industry is experiencing tremendous growth with registered fish collectors increasing from 65 to 144 (Okemwa *et al.,* 2016).

The marine ornamental fish from the wild is monitored and the catch data by area and species are available at State department

of fisheries and Kenya Marine and Fisheries Research Institute (KMFRI). Kenya exports approximately 300,000 pieces of marine ornamental fish annually with and FOB value of USD 66,000 and CIF value of USD 700,000. The marine ornamental fish are exported to United Kingdom, USA, South Africa, Hong Kong, Germany, France, Japan, Netherlands, Austria, Israel, Denmark, Poland, Hungary, Italy, Romania, United Arabs Emirates and Austria (Okemwa *et al.,* 2009). The domestic market is also growing with individuals holding aquaria in hotels, homes and offices as decorations. The export market percentages are shown in Figure 2. The EU is the largest market for the ornamental fish from Kenya with 42% followed by the US with 31% of the market share and the other countries having rather equal market share (Figure 2). In 2014, Kenya exported only 1% of ornamental fish to the EU worth €705,000 and is listed the 5th among the top 10 non-EU sources of marine ornamental fish imported to the EU (OATA, 2015).

Status of fresh water ornamental fish production

Fresh water ornamental fish production is majorly done in captivity whereby fish farmers propagate and rear the fish in ponds, hapas and tanks. The farmed species are dominated by 2 families; Cichlidae and Cyprinidae. This includes different varieties of Gold fish (*Carassius auratus*), Koi carps (*Cyprinus carpio*) and Mollies (*Poecilia spp*.). The varieties of Gold fish farmed include Black moor, Bubble eye, Fantail, Oranda, Lion head, Veintail, Ryukin, White/red comet and Yellow comet. Documentation of the fresh water ornamental fish farmers and other ornamental fish practitioners such as aquarium dealers are not adequately done, for example in 2016, Aquacultural Association of Kenya recorded only 24 ornamental fish farmers in Kenya. The Fresh water ornamental fish produced in the country are non indigenous species which are imported from other countries including Israel and Singapore. In 2013, the importations of fresh water ornamental fish were 20,649 valued at USD 6,290 (SDF, 2013). The freshwater ornamental fish produced by farmers are graded according to intensity of coloration and size according to market requirements and eventually sold both locally and in the East African region.

There are many indigenous fish species with great potential of being ornamental fish in the Kenyan fresh waters especially the fresh water *Cichlids Haplochromis spp*. found in the Lake Victoria basin (Ngugi and Manyala, 2009). The *haplochromis* species with potential of being collected for the ornamental fish include; *Haplochromis nubilus*, *Haplochromis sp*. "blue obliquidens, Haplochromis sp. "Kenya gold", *Haplochromis sp*. "carp", *Neochromis omnicaeruleus*, *Pseudocrenilabrus multicolor victoriae*, *Pundamilia nyererei* and *Astatoreochromis alluaudi*. Other fresh water fish with potential of being collected for aquarium are *Schilbe spp*, *Synodontis afrosfischeri*, *Synodontis victoriae* and *Barbus spp*. There is a great market opportunities for freshwater ornamental fish locally, within the East Africa region and outside the region (Mbugua, 2008). The same markets are being exploited by African countries including Malawi (UNDP, 2011) whose colorful Lake Malawi Cichlids have dominated the EU and US markets. This potential in indigenous fish species need to be tapped for economic gains.

Legal status and regulations in ornamental fish industry and trade

The laws and regulations covering aquatic resources conservation, management and sustainable utilization of aquatic resources rely on the effective implementation of national rules and regulations. Several regulations have been developed to conserve fisheries resources of Kenya. This includes national legislations that have been put in place to deal with the prevention of diseases, introduction of unwanted species into the country and protection of the endangered aquatic resources. The various acts and relevant institutions responsible for their implementation are presented in Table 1.

Table 1: The Acts and regulations related to ornamental fish industry

Name of the Act	Responsible Institution
1. The Fisheries Act CAP 378 (Revised 2012) *The Fisheries (Safety of fish, Fishery Products and Fish Feed) Regulations, 2007*	State Department of Fisheries and Blue Economy, Ministry of Agriculture, Livestock and Fisheries.
2. Animal diseases Act Cap 364 (Revised 2012).	State Department of Livestock, Ministry of Agriculture, Livestock and Fisheries.
3 Pharmacy and Poisons Act Cap. 244 (Revised 2009)	Ministry of Public Health and Sanitation
4 Environmental Management and Co-ordination Act (revised 2015)	National Environmental Management Authority, Ministry of Environment, Natural Resources and Regional Authorities
5 Wildlife Conservation and Management Act Cap.376 (revised 2013) *Legislation on Marine Protected Areas (MPAs).*	Kenya Wildlife Service, Ministry of Environment, Natural Resources and Regional Authorities

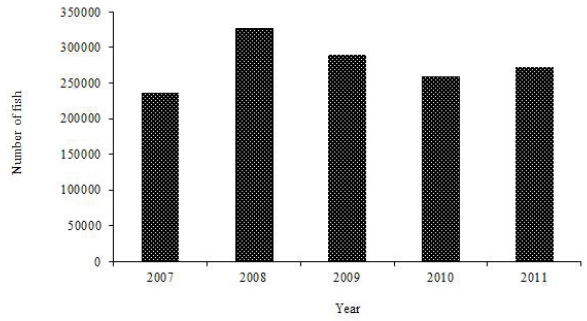

Figure. 1: Annual number of marine ornamental fish collected from 2007 to 2011 (Adapted from SDF, 2011 and Okemwa *et al.,* 2016).

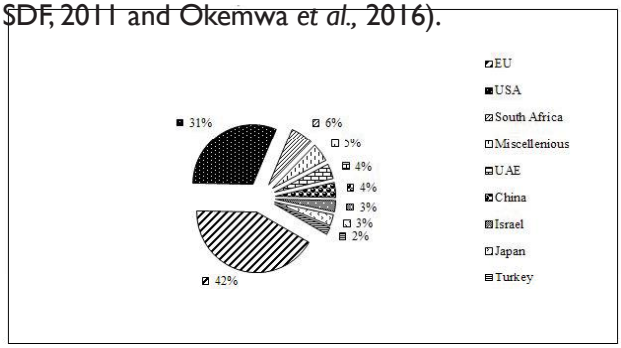

Figure 2: Average Market percentages of ornamental fish from Kenya (Adapted from SDF, 2011).

Quality assurance and biosecurity

Quality control in the ornamental fish industry is by licensing aquarium dealer, fishing or collection of the ornamental fish; control of live fish movement, export and import permits; transfer of ownership and inspections done at the holding facilities to ensure quality. There exist general guidelines for handling of live fish applicable to ornamental fish (SDF, 2015). Generally, the harvested fish are temporarily packaged in plastic bags or containers at the jetty and transported in vans to the holding facilities where they are kept in quarantine for acclimatization to life in captivity, as well as to detect and treat any injuries or infections before shipment. Any fish with infections are isolated and treated, but treatment depends on the level of expertise of the handlers. The fate of fish that do not recover remains unknown although it can be assumed that they eventually succumb to injuries or infections of a fatal nature. The exporters are required to obtain an export permit from the State Department of Fisheries before any consignment can leave the country. Once this is done, the fish that have been certified to be in good condition are then packaged in plastic bags filled with oxygen and sealed. The sealed plastic bags are placed in insulated Styrofoam boxes and taken to the airport where they are cleared by the customs department, and then air freighted to the destination markets.

Limited biosecurity measures have been put in place to monitor new introductions and occurrence of diseases in fish in Kenya. This is due to inadequate human resource specialized in fish diseases. Ornamental fish trade involves introduction of exotic species; possible introduction of diseases and parasites;

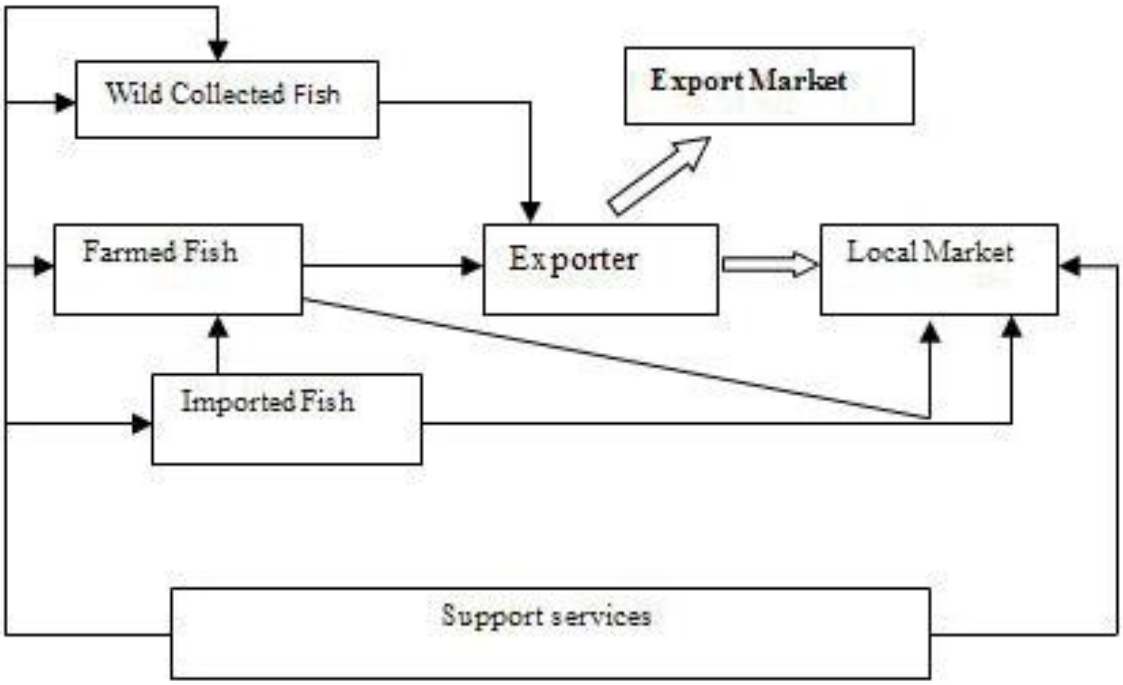

Figure 3: Supply network for ornamental fish in Kenya (Adapted from Okemwa *et al.,* 2016)

possible escapes of fish to the wild leading to ecological and genetic interference with the wild species. Common diseases encountered in Kenya are mainly in the freshwater fish and includes the fish louse (*Argulus spp*) and white spot disease (*Ichthyophthirius multilifis*). The viral disease common in Koi (Koi Herpes Virus) (KHV) has not been reported in Kenya but measures need to be put in place to ensure it does not emerge in Kenya. The Department of Veterinary Services is the Competent Authority for compliance with aquatic animal health, animal welfare measures, and international health certification according to Aquatic Health Code of the World Animal Health Organization (OIE) (SDF, 2015). They are required to check the health status of the fish during quarantine where the fish are held to be shipped from or into the country and in the farms. One of the measures is the issuance of health certificate for transboundary fish movement and the fish health monitoring according to OIE aquatic animal health code. Although this is usually done, there is little monitoring of the fish health in the country and quarantine facilities are not well established in different ports to cater for the different species of fish being traded. In most cases, there is inadequate competence of the Veterinary Officers with regard to fish health management which has posed a great challenge to biosecurity in ornamental fish industry.

Ornamental fish supply network

The supply network for marine ornamental fish in Kenya is simple and short without involvement of middlemen (Okemwa *et al.,* 2016). It runs directly from the collectors to the exporters (Figure 3). The freshwater ornamental fish value chain involves the farmer selling directly to the local market or to the exporter. The value chain of ornamental fish industry is not well structured and the players in the value chain are not clearly defined. The major player in the value chain include the ornamental fish farmer or collector from the wild, aquarium dealer and other support service providers who sell packaging materials and aquarium accessories. Support services in the ornamental fish industry includes; feed supplier (bioflakes and granules); broodstock supplier; research; extension services; veterinary services; infrastructure; maintenance and servicing.

Opportunities in ornamental fish industry

Government policy intervention

The primary goal of the policy is to ensure increased and sustainable fish production and utilization by properly managing the ocean and other fisheries waters. The policies developed focuses on the promotion of aquaculture, implementation and monitoring of sustainable management and responsible fishing practices. The policy guides the development and management of the fishery sector in an effective and coordinated manner in tandem with the national development policy objectives. This is to hasten and enhance the sector's contribution to the country's development objectives of poverty alleviation and wealth creation (MoFD, 2008; Ngugi and Manyala, 2009; MoFD, 2011). Other efforts include the development of marine aquarium fishery management plan which is being carried out to ensure development of a vibrant sustainable ornamental fish industry that provides equitable benefits to all while conserving the long term ecological integrity of the targeted species (Maina, 2012). An enabling policy environment will ensure sustainable growth of the industry.

Industrialization and Employment opportunities

Since ornamental fish is regarded as high value fish, it provides foreign earnings and improves the livelihood of the people involved it the value chain. The industry has served as a source of direct employment in different capacities as fishermen, fish packers, aquarium maintenance personnel, drivers, shallow water and deep sea scuba divers. The sector has also allowed industries to produce materials and equipment used in handling and transportation of live fish. This includes; fish packaging bags, styrofoam boxes, carton boxes, rubber bands, sealing tapes and medicinal oxygen. Other key areas of industrialization include; development of marine aquariums, farming of ornamental fishes, fabrication of aquariums and accessories and production of ornamental fish feeds. These support service industries contributes to employment in the ornamental fish industry.

Unexploited indigenous freshwater ornamental fishes

Lake Victoria and small water bodies in the L. Victoria basin have got numerous indigenous colourful fish which have never been exploited for ornamental fish business. Their exploitation will give a wide variety of aquarium fish to meet the market demand.

Major challenges facing the growth of the industry

Some of the most important challenges include:-

Environmental issues

i. Most of the marine ornamental fishes inhabit the coral reef; therefore the collection of species such as damselfish could lead to habitat degradation and possible threat to the coral reef ecosystem.
ii. The collection of marine ornamental fish targets juveniles and brightly-colored males since they are more colorful and attractive. This affects the population's age structure, and leads to imbalanced sex ratios of the female and male community making the fishery vulnerable to depletion (Dee *et al.,* 2014).
iii. The biology and ecology of the fish species being exploited for the ornamental trade is not always put into consideration. There are some species which cannot survive in aquaria due to their feeding habits like Chaetodon spp. which feed on the coral polyps. This species are still harvested for ornamental fish trade despite the low chance of survival in captivity.
iv. There are existing loopholes with the management of escapes, disposal of unwanted fish and new introductions into the aquatic ecosystem despite the fact that they are possible source of diseases or ecological imbalance to the wild population. In most cases the incoming fish stocks are not traced to ensure they are for the intended use and the quantities monitored from time to time to ensure that there are

no escapes.

Weak implementation of regulations

There are little measures put in place to ensure adherence to regulations concerning sustainable exploitation of ornamental fishes. The management measures have been constrained by limited knowledge on the status of exploited stocks due to lack of species-specific catch data and limited resources to undertake rigorous stock assessment surveys (Dee *et al.,* 2014; Okemwa *et al.,* 2016). The country also lacks a stand alone regulatory measure specific for the ornamental fish industry that should ensure sustainable exploitation, management and development of the sector.

Losses due to high freight charges and taxation

The airlines charge a freight charge, which determines more than 50% of the final market price of the fish because any delays or mishandling of the consignments during transit can influence the ultimate quality of the fish when it lands at the destination market. Consignments are frequently rejected or returned by the airline companies due to inferior packaging resulting in leakages while in transit. Airline carriers incur the costs of transporting rejected consignments back to the exporters. Thus, they are not only major beneficiaries of the marine aquarium trade but they are also negatively affected due to tax enforcement of the set regulations.

Inadequate inputs

Number of stakeholders in ornamental fish industry is very low in comparison with other fish industries especially the food fish industry (both in capture and aquaculture). This makes access to support services and facilities required for ornamental fish trade cumbersome. For example in farmed ornamental fish, there is lack of ornamental fish feed to be used in the production of the cultured ornamental fish. The fresh water ornamental farmers usually use the feeds meant for other cultured food fish and this has a negative effect on the quality of the fish produced. Ornamental fish require carotenoids rich diet to enhance their attractive colours and pigmentations which do not exist in the feeds formulated for the food fish (NRC, 1993).

Lack of priority in investment

In freshwater ornamental fish industry, there is competition for farmland and other agricultural activities. The government agencies have also prioritized food fish production to ensure food security and most of the ornamental fish species e.g. the Cichlids are exploited for food fish industry among the fishing communities. The government funding for fisheries are often used for increasing production of food fish only with little emphasis on ornamental fish.

Conclusion and Recommendations

The ornamental fish industry in Kenya has few players in the export and farming business. However, if more players enter the market then the increased competition for fish collection and farming might result in an increase in profit to the fishers. Therefore economic evaluation of both freshwater and marine ornamental industry needs to be conducted to establish the contribution of the industry to the global trade and the country GDP. The high demand may lead to constraints in the conservation of the resource. This will require research to be focused in developing new technologies to enable captive breeding of the rare and endangered species from the capture fisheries as well as the fish of high demand in the market. It is clear that proper fish health management and quarantine regimes need to be adopted, as current procedures have got several loopholes which can lead to inefficient monitoring of fish in farms and in holding units. These various changes are necessary in order to achieve a sustainable ornamental fish industry in Kenya. Sensitization of the players in the supply network on the national and international laws and strict enforcement of the existing legislation can also improve the industry by monitoring imports and introductions to reduce the risk of ecosystem imbalances, diseases or invasive species. This

will ensure environmental sustainability and social benefits to all. A combination of efficient management strategies and a conducive policy enabling environment can offer a considerable promise for the growth of the ornamental fish industry.

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Public Brief

A stand alone policy on ornamental fish production is required to encourage sustainable management and exploitation of the wild caught marine ornamental fishes and investment in captive breeding of ornamental fishes.

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