

DEVELOPMENT OF FISHING PRACTICES WITHIN COMMERCIAL FISHERIES IN LAKE KARIBA, SOUTHERN AFRICA

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ABSTRACT Freshwater fisheries are an essential component of African fisheries, providing one-third of the total catch. This study focuses on the fishing of a small clupeid, *Limnothrissa miodon*, locally called kapenta, in Lake Kariba. Lake Kariba is shared by Zimbabwe and Zambia, and this study provides a chronology of the commercial kapenta fishing practices used in both countries. It examines how the current fishing methods have become popular among both white and black operators, from environmental and social perspectives. Unlike traditional and artisanal inland fisheries, which have a variety of fishing methods, only one fishing practice is employed in Lake Kariba. This is an artefact of the environmental characteristics of the man-made lake, political situations (settler colonialism and historical inequality between white and black populations), and socialist policies adopted by the Zimbabwean government. A modern fishing method invented by the white settlers has been widely accepted by the new black entrants to fishing and has spread throughout the lake.

Key Words: Freshwater fishing; *Limnothrissa miodon*; commercial fishing; Lake Kariba.

INTRODUCTION

Fish are critically important in terms of food security and nutritional intake among people living in developing countries (Allison, 2011; HLPE, 2014). Although Africa has a lower per capita fish supply (9.8 kg/year per capita in 2013) than Asia (23.0 kg/year) (FAO, 2016), fish are considered an important source of “rich food for poor people” in locations where undernourished populations are high (Béné & Heck, 2005). Furthermore, considering that the African population and urbanization rates will increase more rapidly than in other regions, the demand for food fish will continue to grow (World Bank, 2013).

Freshwater fisheries are an essential component of African fisheries, providing one-third of the total catch (FAO, 2014). Among the regions around great lakes such as Lake Victoria, Tanganyika, and Malawi, and popular rivers such as the Nile, Niger, and Congo basin, a considerable number of people depend on fish as a protein source (FAO, 2014). Many studies have also identified that freshwater fisheries in Africa are economically essential for local livelihoods around lakes and rivers (de Graaf & Garibaldi, 2014; World Bank, 2012). However, potential economic benefits of fishing are often underestimated because statistics of

freshwater fisheries difficult to collect (Welcomme, 2011). Therefore, it is important to shed light on the characteristics of freshwater fisheries and their dynamics throughout Africa to discuss food security and local livelihoods.

Previous studies on freshwater fisheries in Africa have mostly focused on traditional or artisanal fisheries; however, few studies have investigated commercial fisheries targeting a single fish species. For the sake of providing a basis for exploring the diversity and variation of African inland fisheries, this study focuses on small clupeid (*Limnothrissa miodon*) fishing in Lake Kariba, shared by Zimbabwe and Zambia.

L. miodon was originally distributed in Lake Tanganyika. It was introduced to Lake Kariba during 1967–1968. *L. miodon* is called “kapenta” in Zambia and “matemba” in the Shona language. Shona is the dominant ethnic group in Zimbabwe. This paper uses the term kapenta, as it is broadly known in both countries. Kapenta is generally sun-dried and sold at local markets in urban and rural areas, and even in the supermarket in the large urban centers. It is a good source of animal protein for both urban and rural residents.

It is known that inland fisheries tend to be small scale and labor intensive (Welcomme, 2011: 1752). In Lake Tanganyika (the origin of kapenta) sardine fisheries are dominated by artisanal and traditional fishermen. The fishermen in Lake Tanganyika use a variety of fishing methods to target sardines, which are called “dagaa” (*Stolothrissa tanganyicae* and *L. miodon*). These include the ring net, lift net, beach seine, and purse seine net (Munyandorero, 2002; Van der Knaap et al., 2014).

Kapenta fishing in Lake Kariba is more uniform and does not have any variety in fishing methods. Kapenta fishing can be characterized as capital-intensive and semi-industrialized. Modern fishing methods in Lake Kariba (catamaran vessels with diesel engines and steel pontoons) are drastically different from those of Lake Tanganyika.

Some studies identified fishing methods in the early periods of this industry (Langerman, 1979a; Marshall & Langerman, 1979). There are limited studies on current fishing methods and fishing gear used in Zimbabwe and Zambia. To this end, this paper aims to provide a chronological description of fishing practices used for commercial kapenta fishing in Lake Kariba, both from the Zimbabwean and Zambian sides, and examines how the current fishing methods became popular among both white and black⁽¹⁾ operators from an environmental and social perspective.

RESEARCH SITES AND METHODS

I. Lake Kariba and *L. miodon*

Lake Kariba is a man-made lake located at the boundary of Zimbabwe and Zambia. Its surface area is 54,000 km², with a maximum depth of 78 m and mean depth of 31 m⁽²⁾. Approximately 55% of its area belongs to Zimbabwe and 45% to

Zambia. The lake was originally built for hydro-electric generation in colonial times when these countries were formed by the Federations of Rhodesia and Nyasaland.

Fisheries in Lake Kariba can be categorized into two types: low cost, non-mechanized, multi species, inshore artisanal fisheries, and highly mechanized, capital intensive, semi-industrial single species offshore fisheries for the introduced, pelagic, clupeid kapenta (Kolding et al., 2003). The biological, technical, and socio-economic interaction between these two fisheries is considered to be low, and therefore must be treated separately (Kolding et al., 2003).

L. miodon is a small pelagic clupeid. The size of the adult *L. miodon* in Lake Kariba varies from 4.5 to 7 cm, and it is smaller than those found at Lake Tanganyika (9 to 14 cm) (Langerman, 1979b) (Fig 1).

Kapenta is an important food for local consumption and is popular both in urban and rural areas. Although frozen packs of kapenta can also be found at some supermarkets in urban centers, it is usually distributed as a dried fish. As such, it can be stored for a long time and marketed even in remote areas. Local people often prepare it with vegetables such as rape or cabbage, and consume with their staple food (Fig 2).

II. Sites and Methods

Although inshore fishing is conducted by individual fishermen residing in villages along the lake, kapenta fishing is conducted by private companies and other individuals or groups with commercial fishing licenses from urban centers along the lake. This study carried out field surveys at two main bases, Kariba in Zimbabwe and Siavonga in Zambia (Fig 3). The field survey at Kariba was conducted between 2013 to 2014, and between 2013 to 2016 at Siavonga.

The Zimbabwean side of the lake is divided into five basins. Operators have to own a concession license for their respective basin, and are not allowed to fish in other basins without a license. Approximately 168 operators and 392 fishing vessels were registered in Zimbabwe in 2013. Among those, 63 operators (37.5%) and 157 fishing vessels (40%) operated in basin five, mostly from Kariba town. The town is located about 360 km north-west of Harare, the capital city of Zimbabwe, and the population was about 27,000 in 2012 (ZimStat, 2012). Shona people are the largest ethnic group in this country and mainly reside in Kariba, along with the Tonga people and people from Mozambique. The main employment in this town is offered by kapenta fishing, aquaculture, and tourism.

The Zambian side of the lake is divided into four strata. There were 151 operators with 631 vessels in 2011 (DoF, 2011: 27). Among these, 45 operators (29%) with 166 vessels (26%) were located in Siavonga. Siavonga is located about 200 km south of Lusaka, the capital city of Zambia, and has a population of about 16,000 (CSO, 2012). The main employment in this town is also offered by kapenta fishing, aquaculture, and tourism. The Tonga people are the predominant group in southern part of Zambia, but there are also many immigrants from other provinces.

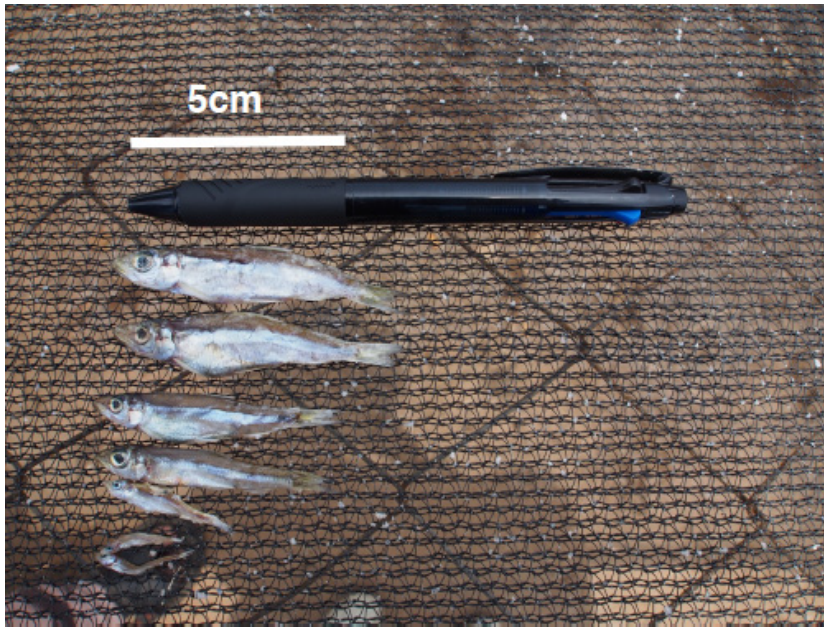


Fig. 1. Fresh kapenta in Lake Kariba



Fig. 2. Kapenta cooked with vegetable

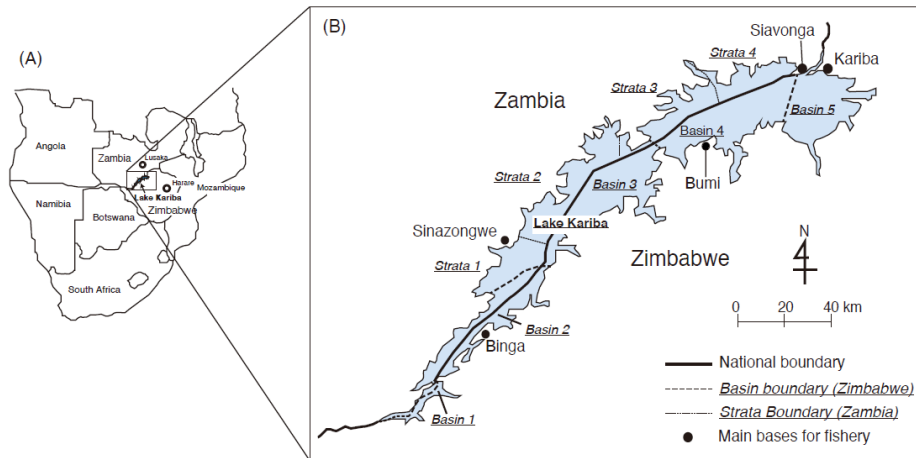


Fig. 3. A) Location of Lake Kariba, B) Basin and major fishing sites for kapenta fishing

Analysis of fishing practices in the early days of the industry is based on secondary sources such as ecological studies by the Lake Kariba Fisheries Research Institute (LKfri), established in Zimbabwe by the colonial government. Information was also collected from long-established operators and engineering companies through interviews.

To identify the current fishing practices in both countries, the author conducted interviews with kapenta operators, fishermen, and engineers at Kariba and Siavonga. The author also conducted participatory observation of fishing and drying of kapenta. Some information on regulations and licenses was also collected from the concerned authorities, the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) in Zimbabwe, and the Department of Fisheries (DoF) in Zambia.

TRANSITION OF FISHING PRACTICES

I. Introduction of Kapenta to Lake Kariba

Surveys to introduce clupeids into Lake Kariba were started in 1963. From the two sardine species in Lake Tanganyika (*S. tanganicae* and *L. miodon*), *L. miodon* was selected to be suitable for Lake Kariba. *L. miodon* were transferred in 1967 and 1968, and were released at Sinazongwe in the Zambian side of the lake. They appeared to be established throughout the lake by 1970 (Marshall & Langerman, 1979).

The fishing industry started on the Zimbabwean side first, with experimental commercial fishing in Zimbabwe beginning in 1973 (Cheater, 1985; Langerman,

1979a). Fishing started on the Zambian side only in the 1980s. This situation was the result of political tensions during that period. During the Zimbabwean war of liberation, the Rhodesian army attacked the bordering Zambian areas, and the road network was damaged by land mines set by the Rhodesian army. Therefore, the fishing activities stopped on the Zambian side during this time (Overa, 2003). After the independence of Zimbabwe in 1980, commercial fisheries in Zambia started the following year (Overa, 2003).

II. Fishing Practices in the Early Days

Early fishing trials were led by the colonial governmental institution, LKFRI, beginning with experimental fishing in 1971 on Zimbabwean side of the lake (Langerman, 1979a). Scoop nets, gill nets, and trawling were unsuccessful. Purse seine nets, lift nets, and chilamila nets (an open water seine net) were considered to have potential. They also tested the efficiency of using lights to attract kapenta. Mercury-vapor lights proved to be effective (Langerman, 1979a).

During this trial, LKFRI confirmed a sufficient density of kapenta in the lake to begin commercial fishing practices. In 1973, the first experimental commercial fishing was carried out by a private company A. From interviews with old-established operators, it was found that company A had already fished in Lake Tanganyika using purse seine nets before they started in Lake Kariba. Company A was asked to fish in Lake Kariba and subsequently brought the fishing vessels and equipment from Lake Tanganyika. Fig 4. illustrates purse seine fishing. This fishing method consists of a mother ship and three small light boats. Langerman (1979a) illustrates this method as follows:

“The mother ship tows the light boats out at dusk and positions them about 500 m apart in the chosen fishing ground where they anchor. The light boats are each equipped with a bank of six to eight 250 W mercury-vapor globes, which are suspended on a frame over the stern of the boat and powered by a 1.5 kV generator. The lights are switched on at sundown, and the seine net is shot around the light boat at four to six hour intervals. The net itself is 230 m long and 36 m deep, made of nylon with a minimum stretched mesh size of 10 mm.” (Langerman 1979a: 108).

The number of hauls at night was six, and the catch ranged from 100 to 800 kg per haul (Langerman, 1979a). It required 10 to 12 crew members to carry out one unit of seine net fishing. Company A was the only company using this large-scale fishing method. Other operators that started in the 1970s tried lift nets and sought to obtain a better catch. Some used a mono-hull with either a square or circular mouth net.

Others used what they called square net (Fig 5). Langerman (1979a) described this as follows:

“More complex methods use boats that are somewhat suggestive of an oil rig,

consisting of a platform supported by two cylindrical pontoons. Four booms rise from the corners of the craft and support the ropes during the raising and lowering of the net. The mouth of the net lies outside and surrounds the boat while the bag is suspended below. The net, which is 15 m square and 8 m deep, is raised and lowered by hand-operated winches; light attraction is achieved by three or four mercury vapor lights above the water and one more light suspended underwater above the mouth of the net. The net is raised, and once the mouth of the net has broken surface, the bag is hauled through a well in the platform of the boat and the fish are removed with scoop nets.” (Langerman, 1979a: 110)

The number of hauls ranged from eight to ten per night, and the average catch ranged from 80 to 120 kg per haul (Langerman, 1979a). It required at least 10 people, as each winch needed two people.

It was found that company A requested to exchange its seine net fishing permit for a dip (lift) net in 1985 since the seine net was labor intensive and became difficult to maintain. Therefore, after 1985, only lift nets were used for kapenta fishing in Lake Kariba.

A type of fishing vessel (now common on Lake Kariba) was invented in the early 1980s by a private engineering company. An owner of the company came to Kariba in 1983 and started his own business. He invented a catamaran type of boat with a deck length of four to five meters (Figure 6). The stability of the vessel was sufficient to cope with strong winds and waves. This vessel had a conical pillar to suspend the net, and workers could raise the net with a single winch. Therefore, with this new type of fishing vessel, only two to three workers were needed for

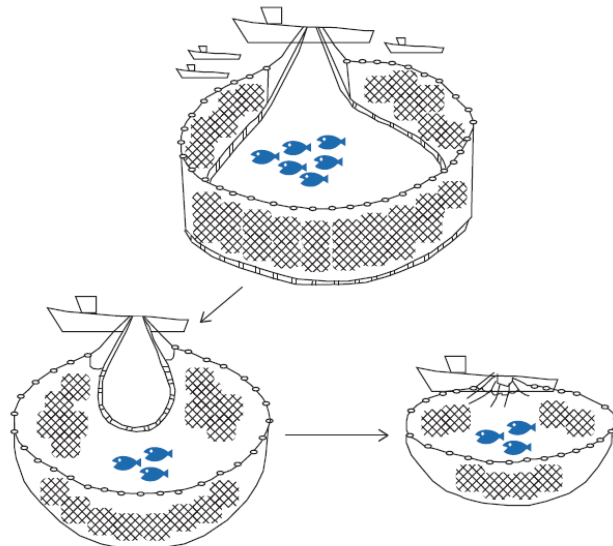


Fig. 4. Diagram of a purse seine net
Source: Modified from Langerman (1979a: 109)

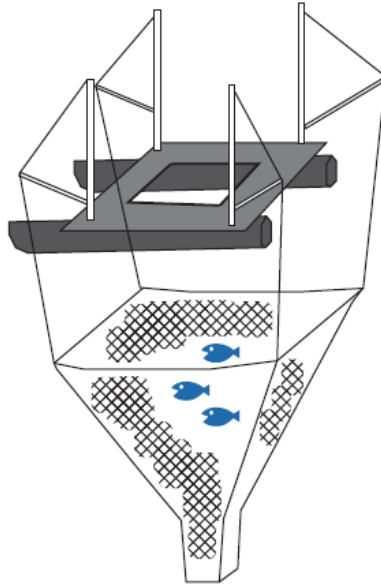


Fig. 5. Diagram of a fishing vessel used for square net fishing
 Source: Modified from Langerman (1979a: 109)

each boat. The circumference of the net ring was 18 to 20 m with a depth of 10 m. This type of vessel became increasingly popular in Zimbabwe and Zambia, and is still commonly being used.

In the early fishing stages of the 1970s and the early 1980s, the operators reported that Japanese and British manufactured engines were commonly used. Some of the manufacturers had come to Kariba and had held a workshop for the operators to demonstrate how to use and maintain their engines. During this period, the operators had already used sonars manufactured by the Japanese company.

III. Spread and Acceptance of Fishing Methods

The colonial governmental institution led the developmental process of kapenta fishing, and some white private operators and engineers joined this business. After Zimbabwean Independence in 1980, the fishing activities along the lake that had stopped because of the liberation war, were restarted in Zambia. Since the capture of kapenta required a particular type of fishing vessel and lights, the inshore fishermen and locals on the Zambian side could not venture into this business because of a lack of funds. Thus, although Zambia was already independent in 1964, only businesspersons within Zambia or from Zimbabwe and South Africa ventured into kapenta fishing (Overa, 2003). Since vessel usage and methodology had already been experimented with on the Zimbabwean side, these new Zambian

operators imitated the Zimbabwean operators.

After Independence in Zimbabwe, kapenta fishing became open to black people. Since the new government adopted socialist policies, they promoted the formation of cooperatives. Licenses were first issued to new cooperatives in 1986. C and N cooperatives represented the first locals to venture into kapenta fishing and started their businesses in 1987. These cooperatives were financially assisted by the government (Nyikahadzoi, 2002), so that they could build a fishing vessel similar to those being used by existing operators. N cooperative reported that well-established operators offered great support to them once they had started. When the N cooperative started, they operated from one well-established operator's premises in order to learn about fishing vessels, methods, and equipment. Furthermore, some of the members of cooperatives that started in the 1980s and early 1990s had worked at the existing operators' as fishermen or general workers. Thus, these experiences made it easier for the new black operators to accept and adopt the same method.

CHANGES IN THE KAPENTA OPERATORS

The characteristics of the operators are related to the fishing practices of that time. Therefore, before describing the current fishing practice, it is important to note the characteristics of the operators.

After 2000, there were many local black operators engaged in kapenta fishing, facilitated by the socio-political backgrounds of each country. Fig 7 illustrates the



Fig. 6. Fishing vessel used for kapenta fishing in Lake Kariba

changes in the composition of operators and the total number of fishing vessels in Zimbabwe. In Zimbabwe, only white people were involved in commercial fishing until Independence. It was not until the late 1980s that the first black operators joined as cooperatives with strong support from the new government. However, in the 1990s, catches did not increase despite the increase in operators, due to the over-exploitation of resources. The ZPWMA then adopted precautionary approaches to issuing new licenses. Licenses were issued progressively with fish length and catch size monitoring (Nyikahadzoi, 2002). After 2000, the redistribution of fishing licenses dramatically altered the characteristics of operators on the Zimbabwean side of the kapenta fishing industry by increasing the number of black operators. The government adopted a radical approach to the redistribution of fishing licenses, similarly to that seen in agricultural land reform. As a result of redistribution, some existing black operators received permission to increase the number of vessels they operated. New operators, including youth and women, entrepreneurs, and war-veterans benefited from the redistribution (Nyikahadzoi & Raakjær, 2009).

In Zambia, the numbers of local black operators increased under the influence of economic liberalization in the 1990s and economic growth after the late 2000s. The number of operators increased from 52 in 1994 to 151 in 2011, and the number of fishing vessels increased from 175 in 1994 to 632 in 2011 (DoF, 2011). Of these 632 fishing vessels, 476 were operated by those who had been in this business for less than 10 years. In addition, 66% of the vessels were owned by individuals (DoF, 2011). This increase in operators and boats represented the entry of new local individuals into the industry. From the interviews with DoF, it was found that most of the new operators started kapenta fishing as an additional income source in order to diversify and improve their livelihood.

Therefore, in both countries, the composition of operators has changed since the inception of the kapenta fishing industry as more black operators joined the industry.

CURRENT FISHING PRACTICES

Since 2015, Zimbabwean and Zambian operators agreed to an official regulation of seven days closure per month; thus, they fish for about 23 days in a month(3). In both of the countries, kapenta operators must have fishing permits.

I. Kapenta Fishing in Zimbabwe

In Zimbabwe, two fishermen are allocated to each fishing vessel, one acting as the “captain” to drive the vessel and the other as the “assistant” to help raise the net. The description presented here is based on participatory observation with N cooperative fishermen, conducted on December 15, 2014.

N cooperative operated two fishing vessels at that time. Most operators with more than one fishing vessel left their vessels on the lake with one worker for each boat, with one boat responsible for returning to the dock with their catch of the day. This method decreased the diesel fuel costs. The worker remaining on the lake was

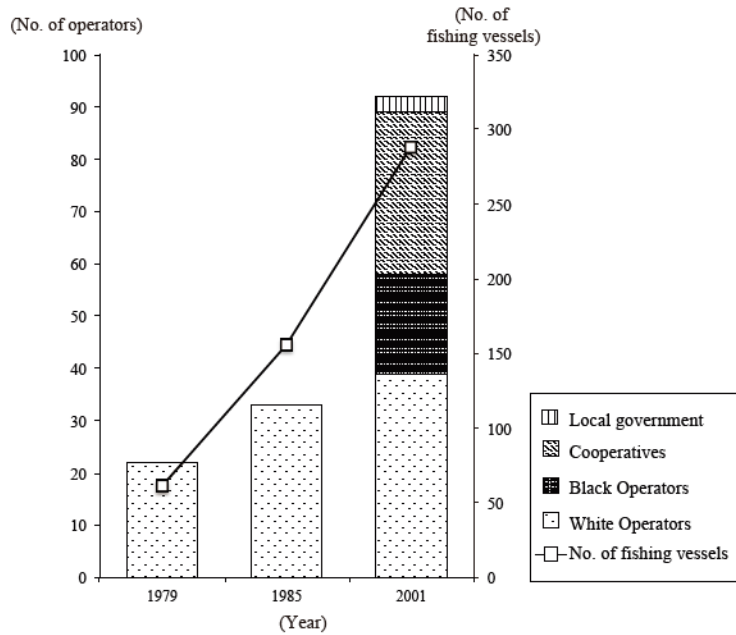


Fig. 7. Changes in the composition of operators and total number of fishing vessels in Zimbabwe
 Source: Modified from Table 1 in Nyikahadzoi & Raakjær (2009: 640)

referred to as being on “lake duty”. In the case of N cooperative, the assistant of one vessel remained on the lake from the previous day. There were three fishermen, two captains and one assistant, who departed from the harbor on this day. They assembled at the premises at around 15h00 and received some of the equipment from the cooperative members. At 16h00, they boarded the vessel and departed. One member of the cooperative also boarded the vessel to supervise.

Destinations were determined through consultation between the captain and operators based on the previous day’s catch and information from other operators and fishermen.

The outgoing vessel met with the vessel on the lake by 19h00, and they subsequently separated to go to their respective fishing destinations. The first fishing destination was decided by 20h00. The captain confirmed the depth of fish using sonar. He then stopped the engine and started the electric generator to put the top lights on (Fig 8a). After 20 min, the underwater light was turned on and placed into the lake. Normally they waited for 1–2 h for fish to gather around the light. Before raising the net, the lights were turned off. The captain and assistant then raised the net using a manual winch (Fig 8b/c). The catch was placed in boxes, and salt was mixed with the fish. Salting is practiced in Zimbabwe but not in Zambia.

They repeated this operation until around 05h00. The number of hauls on this night was five. When they returned, one vessel remained with one worker on the

lake and another vessel carried the catch and the rest of the workers. Based on the interviews with other operators, the number of hauls varied between five and eight per night, but there was little difference in kapenta fishing methods.

After the vessel arrived at the harbor, the operators collected the catch and transported it to their property. The catch was weighed, recorded, and dried. The operators employed workers for drying kapenta or, in case of cooperatives, the members of the cooperatives dried fish themselves (Fig 8d/e). During the dry season, the catch dried within a day. After drying, it was packed and ready for sale (Fig 8f).

II. Kapenta Fishing in Zambia

Although the Zambian method of fishing is almost the same as in Zimbabwe, the number of fishermen for each boat is different. In Zambia, four fishermen were allocated to each vessel. One was called the “captain” and the others were called “clues”.

It was common among black operators in Zambia to keep the vessels along the islands on the lake. From these islands, the fishing vessels departed to their fishing grounds and returned to process and dry the fish. Every seven days, the operators visited the island in small boats to collect the kapenta catch. The operators carried food and equipment needed for maintenance. Fishermen and workers that were employed to dry kapenta lived on the islands, but returned to the mainland when the fishing season closed because of the full moon.

White operators, on the other hand, did not operate in the same manner as black operators, because they feared that fishermen and workers would sell the catch to the local market if left alone on the islands. Therefore, the white operators in Zambia functioned in the same manner as in Zimbabwe and returned to the harbor with their catch every day with one vessel, while the remainder of the fleet remained on the lake.

III. Fishermen in Kapenta Fishing

Unlike traditional and artisanal fishermen, kapenta fishing consists of the operators or directors who have the permit and fishing vessel, and the fishermen and other employees for drying kapenta. Since kapenta fishing in Lake Kariba was mostly based in the urban areas, most of the fishermen were urban dwellers or migrants from the surrounding rural areas. Fishermen were highly mobile as it was common to shift from one operator to another in a short time period. They often quit their jobs due to clashes with the operators. The operators could find substitutes for fishermen easily since people looking for jobs frequented the harbor. Except for the captain who needed experience in kapenta fishing, the operators could employ anyone as fishermen since they could perform the tasks without a deep understanding of fishing. In Zimbabwe and Zambia, fishermen were paid depending on the catch. For example, in Zimbabwe, it was 10 cents (USD) per 1 kg of fresh kapenta. They were offered extra bonuses for the lake duty or when they obtained a good catch.

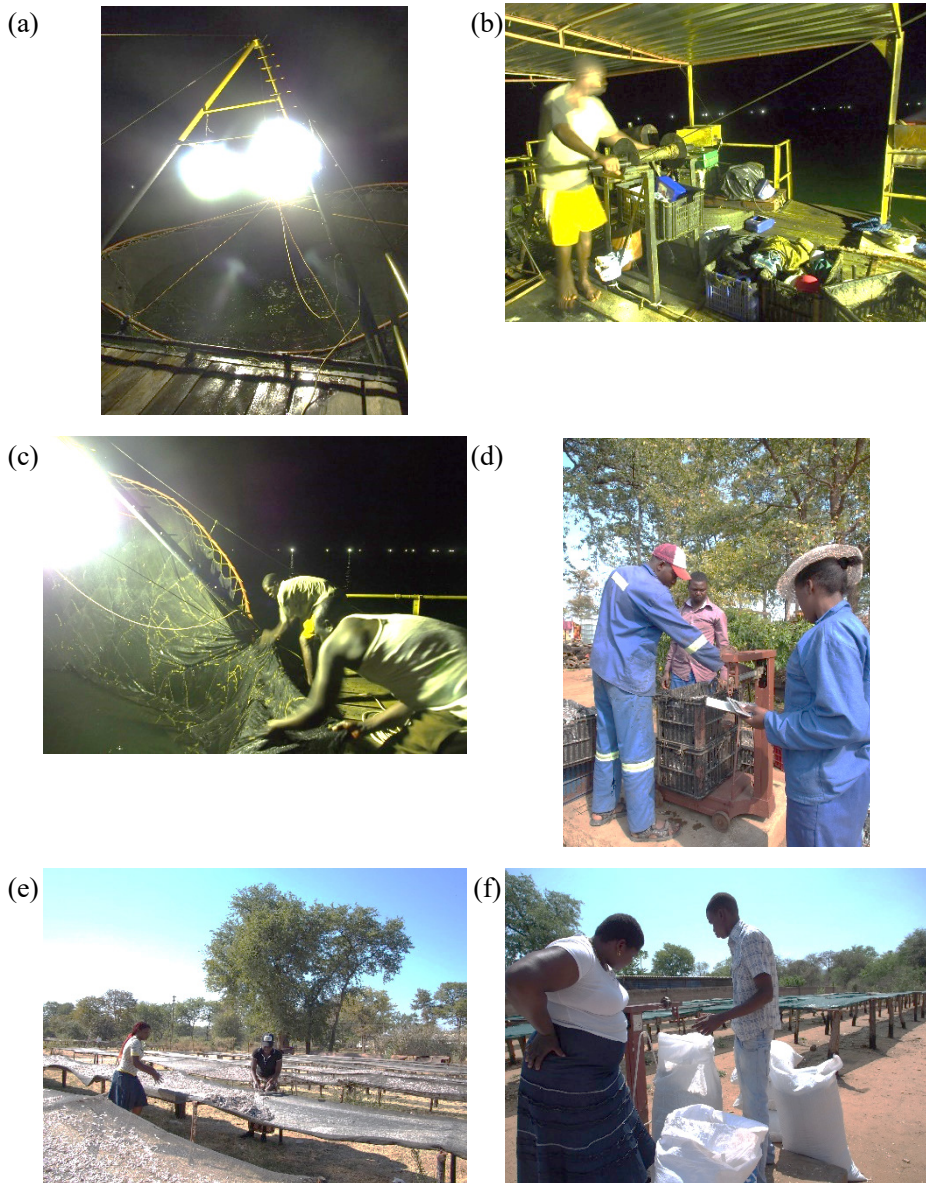


Fig. 8. Process of Kapenta fishing in Zimbabwe

A) top lights, B) raising the net using the winch, C) taking the catch from the net, D) weighing the catches, E) drying kapenta on racks F) Packed kapenta: local traders negotiating the price

IV. Structure of the Fishing Vessel and Equipment

In Zimbabwe, the common size of the deck of the fishing vessels was 6 m long and 5 m wide. Most of the decks were built with wooden planks. The owner of the vessel preferred wood planks to iron sheets as it prevented the risk of electrical shock. There were some differences in engines used by the operators. The vessel had two engines for movement and electricity. There are several types of commonly used engines, from European and Asian manufacturers. The Chinese manufactured engine became popular after 2000 among small-scale black operators (Fig 9). It sold in the range of 700 to 900 USD. It was cheaper and more affordable than other European-made engines.

In Zambia, it was identified that decks were longer than Zimbabwean vessels. Larger vessels were 12 to 16 m long, and smaller vessels were eight to nine m long. The width of the deck was four to five m. Zambian operators and engineers claimed that the size of the fishing vessel did not relate to the catch. They noted that the reason of increasing the size of the decks was simply a matter of personal preference, or to transport more material. Common engines used in Zambia were the European-made, and the Asian-made engines. Similar to Zimbabwe, Chinese engine became popular among the black operators because of its low cost.

As described above, Zimbabwean operators have used fish sonar since kapenta fishing started in the 1970s. Most operators still use fish sonar. However, it was not as common to use sonar in Zambia as it was in Zimbabwe. White operators used sonar, while most black operators did not.

Two types of lights were used for attraction: the top light and the underwater light. The number of lights and wattage differed by operator in both countries. The number of top lights ranged from two to five, with one to two underwater lights. Automatic and manual winches were used to raise the nets. White operators often used automatic winches and operators mostly used manual winches. Fishermen reported that they could only dip the net in 15 to 25 m depths with manual winches because it became too difficult to raise the nets from deeper waters. Therefore, they had problems with catches when kapenta seasonally migrated into deeper waters in the lake.

DISCUSSION

I. Environmental Factors Affecting Fishing Practices in Lake Kariba

The operators of Lake Kariba claimed that if they used a wooden boat such as the mono-hulls used on Lake Tanganyika (Fig 10), they would overturn during the heavy storms on the lake. Therefore, they preferred a more secure and stable type of catamaran boat made of steel.

Table 1 shows the differences in characteristics of the two lakes. The average depth of Lake Kariba is 31 m, with a maximum depth of 78 m. The average depth of Lake Tanganyika is 572 m, with a 1471 m maximum depth. At Lake Kariba,



Fig. 9. Chinese engines commonly used among black operators

fishermen let down the anchor then switch on the lights and wait for an hour or two. They gain stability with the anchor while they are waiting, or during rain and storms. In contrast, fishermen in Lake Tanganyika cannot let down an anchor since the water of Lake Tanganyika is much deeper than that of Lake Kariba. There are also big differences in transparency. Lake Tanganyika is known to have high transparency. Beach seine and purse seine nets can be operated easily because the fish are clearly visible.

Some operators referred to the presence of dead trees for the ineffective spreading of purse seine nets in Lake Kariba. As shown in Fig 11, many dead trees exist from the shoreline to off-shore. The Zimbabwean pioneer company A tried to remove the trees when they started purse seine fishing in Lake Kariba, but all the trees could not be removed. It is alleged that this company stopped its purse seine fishing after some years partly because of the dead trees.

II. Social Factors Affecting Fishing Practices in Lake Kariba

The process of establishing a kapenta fishing practice was also affected by social events in Zimbabwe and Zambia. Table 2 shows some important social events in both countries with the development of kapenta fishing.

In 1965, two years before kapenta were introduced to Lake Kariba, Rhodesia issued a unilateral declaration of independence (UDI). A war of liberation ensued between the colonial state and nationalist parties such as ZAPU and ZANU with their military forces in 1979. Around 1972, after the experimental commercial fisheries began in Lake Kariba, guerrilla activities by liberation forces escalated.



Fig. 10. Fishing vessel used for kapenta fishing in Lake Tanganyika

Note: At Lake Tanganyika, they use a larger boat called a mother ship, and several small satellite boats to catch kapenta. In this picture, the mother ship is loaded with the small boats.

Table 1. Characteristics of Lake Kariba and Tanganyika

| | Lake Kariba | Lake Tanganyika |
|-----------------------------------|-----------------|--------------------------------------|
| Surface Area (km ²) | 5,400 | 32,000 |
| Volume (km ³) | 160 | 17,800 |
| Mean Depth (m) | 31 | 572 |
| Maximam Depth (m) | 78 | 1,471 |
| Shoreline (km) | 2,164 | 1,900 |
| Altitude (m) | 485 | 773 |
| Catchment Area (km ²) | 663,000 | 263,000 |
| Transparency (m)* | 5.3 | 9.6 |
| Major inflowing river | Zambezi | Rusizi/Malagarasi |
| Morphogenesis | Dam | Tectonic |
| Basin countries | Zambia/Zimbabwe | Burundi/DR Congo/ Tanzania/Zambia |

*Source: ILEC World Lake Database. Transparency of Lake Kariba is the average of Sanyati Basin in 1983. Transparency of Lake Tanganyika is from Plisnier (1997).



Fig. 11. Dead trees in Lake Kariba

On the Zambian side of the lake, all fishing activities, including commercial and artisanal fishing, ceased because of attacks by the Rhodesian army.

Because of separatist ideologies at the time, the black population in Zimbabwe was treated as a labor force in the commercial agricultural sector and in other economic activities by white settler enterprises. Black people were restricted in economic activities and excluded from profitable opportunities, and kapenta fishing was dominated by white enterprises (Nyikahadzo, 2002). Consequently, only governmental research institutes and white enterprises explored fishing methods for kapenta.

Fishing practices were associated with labor shortages during this period in Rhodesia. One operator who started kapenta fishing in 1977 explained that it was a major problem in the late 1970s for operators to obtain adequate labor. Rhodesia acquired substantial migrant labor from neighboring countries such as Malawi, Mozambique, and Zambia. However, during the UDI period and the liberation war, the number of immigrants from neighboring countries decreased, whereas the number of local blacks who migrated to South Africa increased (Zinyama, 1990). Under these circumstances, white operators sought an efficient fishing method and the best fishing vessels, which they could operate with less manpower than that required for purse seine fishing.

After the independence of Zimbabwe was declared, kapenta fishing started on the Zambian side. The Zambian government at that time adopted socialistic

Table 2. Transition of kapenta fishing and important social events in Zimbabwe and Zambia

| Year | Event relating to kapenta fisheries | Important social events in Zimbabwe and Zambia |
|-------------|---|---|
| 1959 | Construction of the Kariba dam completed | |
| 1964 | | Independence of Zambia |
| 1965 | | Rhodesia's unilateral declaration of independence |
| 1967-68 | Introduced kapenta from Lake Tanganyika | |
| 1969 | Identified Kapenta were well distributed | |
| 1971 | (Zimbabwe) Experimental fishing started by LKFRI | |
| 1972 | | Liberation war escalated in Zimbabwe |
| 1973 | (Zimbabwe) First experimental commercial fishing started by I&J | Closure of border by Zambia |
| late 1970s- | Spread of catamaran boat with lift net | |
| 1980 | | Independence of Zimbabwe |
| 1981 | (Zambia) First fishing permit were issued | |

economic policies. It was not easy for local black people to enter the capital-intensive kapenta fishing. As a result, only white entrepreneurs invested in this business in the 1980s.

In Zimbabwe, black people entered into commercial fisheries as cooperatives with support from the new government. Cooperatives received advice and support from white operators, and some had experience working in kapenta enterprises of white operators. It was easy for them to duplicate the same fishing practices that they had learned, and the same fishing practices were espoused throughout Lake Kariba.

Although catamaran-type vessels made of steel with lift nets were the only popular fishing practice in Lake Kariba, there were several differences between the two countries and among their operators, such as the size of the deck, type of engine, number of lights, and use of sonar. In particular, Chinese engines and equipment were common among black operators in both countries.

It is widely known that China has become an important business partner with Africa in recent years (Taylor, 2006; Tull, 2006). Zambia is one of the African



Fig. 12. Chinese fishing lights sold at Siavonga

countries with which China has a strong partnership because of the copper mining sector (Davies et al., 2008). As shown in Fig 12, Lusaka and other regional urban centers are stocked with Chinese commodities, including fishing equipment, such as lights.

After land reform started in 2000, the Zimbabwean government started to receive unfavorable treatment from Western countries. It adopted a new policy known as the “Look East Policy” and consolidated partnerships with China (Chigora & Dewa, 2009). In both countries, therefore, the strong relationship with China and the increasing flow of cheap Chinese commodities (including fishing equipment and engines) facilitated the pursuit of kapenta fishing by black operators with less expenses than before.

CONCLUSION

This study provides a chronological description of commercial fishing practices of kapenta in Lake Kariba, both on the Zimbabwean and Zambian sides, and examines how the current fishing method has become popular among both white and black operators, from environmental and social perspectives.

Unlike traditional and artisanal inland fisheries, with a variety of fishing methods, only one popular fishing practice is conducted in commercial/industrial fisheries in

Lake Kariba. This is an artefact of environmental characteristics of the man-made lake, political situations, and socialist policies adopted by the new government. Notably, this modern fishing method invented by white settlers has been widely accepted by the new black entrants and has spread throughout the lake.

Recently, kapenta catches have declined (Magadza, 2011; Ndebele-Murisa, et al., 2011) and there are discussions of the over-exploitation of kapenta and the increase in illegal fishing activities in Lake Kariba (Nyikahadzoi & Raakjær, 2009; Overa, 2003). To achieve sustainable resource use in Lake Kariba, it will be important to consider not only ecological and economic aspects of the fishing, but also the historical and social imperatives of this unique fishing practice.

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NOTES

- (1) It is not appropriate to use the words “white” and “black” at the risk of perpetuating these disparities. However, here these words have been used because, as terms, they reflect historic differences in political, social and economic contexts in southern African countries.
- (2) ILEC World Lake Database (<http://wldb.ilec.or.jp/Details/lake/AFR-04>) last accessed on April 1, 2016.
- (3) Even before this regulation was implemented, operators in both counties usually terminate fishing activities about a week before/after full moon as it is too bright for kapenta fishing.

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