

ECONOMIC IMPACT OF THE *DAGAA* PROCESSING INDUSTRY ON A COASTAL VILLAGE IN ZANZIBAR, TANZANIA

Mariko FUJIMOTO

Graduate School of Asian and African Area Studies, Kyoto University

ABSTRACT This study examined the structure and development of the *dagaa* processing industry and the resultant income generation in a coastal village in Zanzibar, Tanzania. *Dagaa* are several species of small, pelagic fish, primarily in family *Engraulidae*. This new industry has developed in the past decade in response to the demands for fish products in the Democratic Republic of the Congo, which is the destination for most of the dried *dagaa* products produced in Tanzania. Here, I examine the process of producing dried *dagaa* products and the wage systems used in the industry. Then, I examine the economic impacts of the *dagaa* processing industry in the study area, where approximately 50% of the adult population obtain cash-earning opportunities from the *dagaa* processing industry and the income they receive is sufficient to cover average household expenditure. Finally, I examine the secondary effects conferred by the *dagaa* processing industry such as increased financial stability and food security.

Key Words: Income generation; *Dagaa* processing industry; Food security; Zanzibar.

INTRODUCTION

Small-scale coastal communities in rural areas, especially those of developing countries, are recognized as being the most disadvantaged and vulnerable part of society (Jazairy et al., 1992; Béné, 2003). Many studies have emphasized the importance of livelihood diversification for vulnerable societies of rural Africa (Ellis, 2000; Barrett et al., 2001). Most households in the coastal areas of Zanzibar are involved in the fishery sector and related activities such as boat construction or the processing or selling of fish (RGoZ, 2014). In Zanzibar, income poverty is still a common phenomenon in many of the rural and urban areas, and accessibility to food depends very much on cash income and purchasing power (RGoZ, 2007).

In this paper, I examine the newly developed fish processing industry in a coastal community in Zanzibar and analyze the impact of the industry on the community's individuals. In the late 2000s, the fishing and processing of several species of small pelagic fish, collectively called "*dagaa*" in Swahili, expanded in Zanzibar. Most *dagaa* is sun-dried and exported to the Democratic Republic of the Congo (DRC). Many exporters based in the DRC come to Zanzibar to buy dried *dagaa* and transport it to Lubumbashi in southeast DRC. In West and Central African countries, shortage of protein sources is a serious problem, and as a result the demand for animal protein is increasing (Brashares et al., 2004; Kimura et al., 2012; Komatsu & Kitanishi, 2015; Oishi & Hagiwara, 2015). In these areas, the main source of protein has changed from bushmeat to fish. Reasons for the

decline in the use of bushmeat are the expanding cacao plantations in Ghana (Komatsu & Kitanishi, 2015), increasing commercial hunting because of the long-term civil war in the DRC (Kimura et al., 2012), and the commercial logging and deforestation in the Republic of Congo (Oishi & Hagiwara, 2015).

The demand for fish products for human consumption has been rapidly increasing in recent years in the countries neighboring Tanzania. According to Trade Map data available on the International Trade Centre's (ITC) website, from 2001 to 2007 the annual export of fish products (including dried or salted fish, but not smoked; excluding fillets, offal, and cod; product 030559) from Tanzania to the DRC was 457 tons on average, whereas from 2008 to 2014, it was 3,717 tons on average. In line with this trend, the export of *dagaa* from Zanzibar to the DRC has also rapidly increased in the past decade. In the mid-2000s, many *dagaa* exporters started coming to Zanzibar from the DRC to purchase dried *dagaa*. Many *dagaa* landing and processing sites were established during this period on the west coast of Unguja Island, the main Island of Zanzibar.

In the study site, the *dagaa* processing industry was established in 2010. Before then, there were very few wage labor and business opportunities; however, the *dagaa* processing industry now provides several cash-generating opportunities for the local people. Thus, this new industry has dramatically changed the economic circumstances of the area.

In this paper, I describe 1) the structure of the *dagaa* industry, 2) the processing of *dagaa* into dried *dagaa* products, 3) the wage systems used by the *dagaa* processing industry, and 4) the economic impact of the *dagaa* processing industry on the study site. The findings of this study provide instructive information for poverty reduction, household livelihood diversification, food security, and resource management in the study area and in Zanzibar in general.

STUDY SITE AND METHODOLOGY

Zanzibar is an island area of the United Republic of Tanzania comprising two large islands, Unguja, which is commonly known as Zanzibar Island, and Pemba, as well as several dozen islets in the Indian Ocean. The islands of Unguja and Pemba have a combined 880 km of coastline, which is about 60% of Tanzania's total coastline of 1,424 km.

Zanzibar is divided into five administrative regions, three in Unguja and two in Pemba. Each region is divided into two districts; there are six districts in Unguja. Zanzibar Town, the center of which is known as Stone Town, is located in Unguja Urban/West Region. Stone Town was declared a UNESCO World Heritage Site in 2000. Many tourists visit Zanzibar to see the historical Arabic streets in Stone Town and enjoy the beach resorts and marine sports on the white-sand beaches, which are mainly located on the east coast of Unguja Island (Fig. 1).

I conducted my field research on Unguja Island. The main research site, M village⁽¹⁾ belongs to Unguja North Region and is located on the west coast of Unguja Island facing a bay; however, it is remote from the trunk road connecting Zanzibar Town to the Region's capital Mkokotoni. The residents of M village

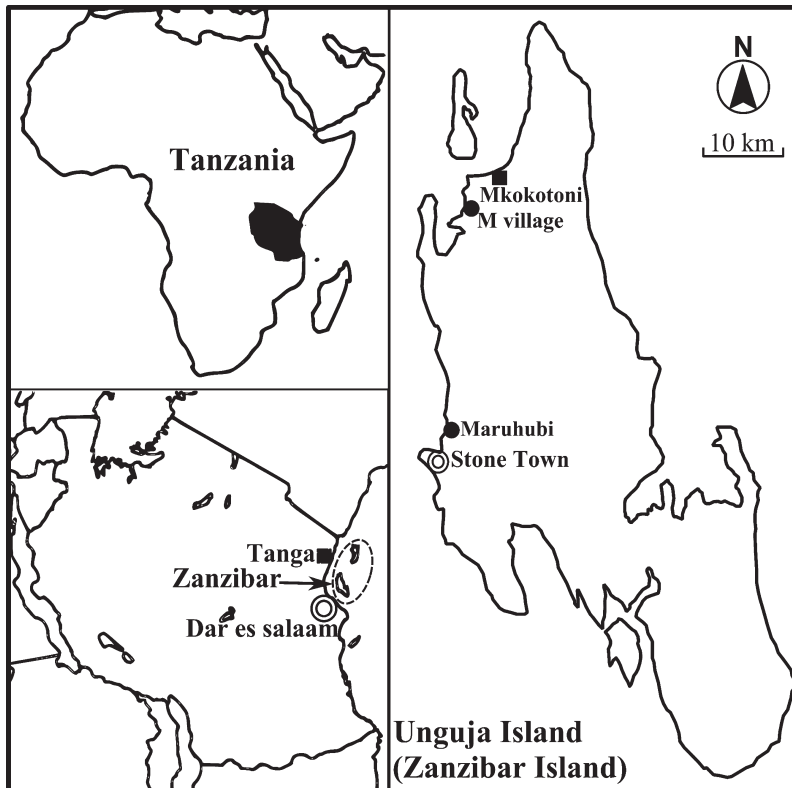


Fig. 1. Map of the study site.

have to travel more than 5 km along an unpaved road from the main road to reach their homes. It takes about 50 minutes to go to Zanzibar Town from M village by bus, and a one-way bus ticket costs TZS (Tanzanian shillings) 1,300.⁽²⁾ In 2012, the population of M village was 950 (males: 485, females: 465; 0–19 years old: 477, over 20 years old: 473) comprising 194 households (NBS & OCGS, 2013). Before the establishment of the *dagaa* processing industry, many people engaged in subsistence agriculture of crops such as rice, cassava, tomato, and cucumber, and sold the surplus within the village. There were very few cash-earning opportunities because of the village's poor access from Zanzibar Town and because of its dark-sand beaches with mangroves, which are not attractive to tourists. Moreover, there were no fish landing sites or fish markets in the village, which did not attract any fishing boats for selling fresh fish. This meant that the people of M village had to secure protein sources by fishing on foot and collecting crustaceans. Occasionally, fish vendors would come by motorcycle from Mkokotoni, where a large fish-landing site and fish market is located.

In 2010, a *dagaa* processor, Mr. S, who buys fresh *dagaa* from fishing boats and processes them to make dried *dagaa*, came to M village to set up a *dagaa* processing business. Mr. S used to engage in the *dagaa* processing business in

Maruhubi, which has the largest *dagaa*-landing and processing sites in Unguja Island and is located a distance of only 5 km north from the center of Zanzibar Town. In Maruhubi, many people from not only within Unguja Island, but also Pemba Island and mainland Tanzania, especially Tanga, joined the *dagaa* processing business. In the late 2000s, the *dagaa* processing industry expanded; however, some problems arose. For example, the competition for buying fresh *dagaa* from fishing boats increased, and stored dried *dagaa* products were sometimes stolen by business competitors. Therefore, Mr. S searched the frontiers of the *dagaa* processing business and decided to make M village his new base in 2010.

I conducted participatory observations and interviews of the residents of M village in the Swahili language from February to March and from August to September 2013. I collected the following data and information with the cooperation of my research assistant: 1) number of buckets of fresh *dagaa* landed per day for one year, 2) unit price of fresh *dagaa*, which changes depending on the fishing boat and size of the catch, 3) description of the *dagaa* drying process and wage systems used by the industry, and 4) how many people have joined the industry as middlemen or processing workers.

BASIC INFORMATION ABOUT *DAGAA* SPECIES AND FISHING

I. Species and Local Names of Indian Ocean *Dagaa*

I collected *dagaa* specimens and identified their species based on their appearance (FAO, 1985a; 1985b; 1988; Smith & Heemstra, 1986). Table 1 shows the local and species name of *dagaa* collected in Zanzibar. The main species of dried *dagaa* exported to the DRC is called *dagaa tonge kwa tonge* in the local language (Photo 1); however, it is colloquially referred to as *dagaa tonge*. It includes

Table 1. Local and scientific names of *dagaa* caught in the Indian Ocean

	Local name			Scientific name	Family name
	Zanzibar	Dar es Salaam	Tanga		
Primary species	<i>dagaa tonge kwa tonge</i>	<i>dagaa mchele</i>	<i>dagaa uono</i>	<i>Stolephorus commersonii</i>	Engraulidae
				<i>Stolephorus indicus</i>	Engraulidae
Secondary species	<i>dagaa la kukosha</i>	<i>dagaa la kukosha</i>	<i>dagaa la kukosha</i>	<i>Spratelloides gracilis</i>	Clupeidae
	<i>dagaa mono</i>	<i>dagaa mono</i>	<i>dagaa mono</i>		
Bycatch species	<i>dagaa upapa</i>	—	—	<i>Amblygaster sirm</i>	Clupeidae
	<i>dagaa saradini</i>	—	—	<i>Sardinella albella</i>	Clupeidae
	<i>dagaa bunju</i>	—	—	<i>Lagocephalus guentheri</i>	Tetraodontidae
	<i>dagaa utajiju 1</i>	—	—	<i>Upeneus tragula</i>	Mullidae
	<i>dagaa utajiju 2</i>	—	—	<i>Emmelichthys struhsakeri</i>	Emmelichthyidae

(Source) Field survey by author and previous studies (FAO, 1985a, 1985b, 1988; Smith & Heemstra, 1986).

two species, *Stolephorus indicus* and *Stolephorus commersonnii*, both of which are types of anchovy in family *Engraulidae*. *Dagaa tonge* is also fished along the coastal areas of mainland Tanzania and it has different local names based on the fish landing area. It is called *dagaa mchele* in Dar es Salaam and *dagaa uono* in Tanga. The word “*mchele*” means rice. People say that the name *dagaa mchele* derives from its characteristic white body and abundant availability like rice. The second species of *dagaa* that is caught and dried for human consumption and distributed only within Zanzibar is *Spratelloides gracilis*. It has two local names, *dagaa mono* and *dagaa la kukosha*, but both refer to the same species. It is sometimes fished together with *dagaa tonge*. In Pemba Island and some areas of Unguja Island, this is the target species that is processed into dried *dagaa*. However, it is not exported to the DRC. Some other species of small fish are caught with the target species and are considered bycatch. Hereafter, the word *dagaa* refers to *dagaa tonge*.

II. *Dagaa* Fishing Period and Method

Dagaa fishing is done by using wooden boats with outboard motors and a purse seine net. *Dagaa* are caught only in the internal sea between the Tanzanian mainland and Unguja Island, and *dagaa* landing sites are concentrated along the west coast of Unguja Island. Fishermen work at night with fish lights for three weeks a month between the 20th and 10th days of the lunar calendar when the moon is small and dark; when the moon is large and bright, fishing is suspended for about 10 days. This cycle repeats throughout the year. Fishing boats return to the landing sites in the morning to sell their catch. The captain calls middlemen over the phone and negotiates a selling price before deciding where to land.

OVERVIEW OF THE *DAGAA* INDUSTRY

I. Structure of the *Dagaa* Distribution Channel

After fishing, the greater part of the catch is processed into dried *dagaa* products by middlemen and most of these dried products are exported to the DRC, although some are distributed within Tanzania. Fig. 2 shows the *dagaa* distribution channel. There are around 10 *dagaa* landing and processing sites along the west coast of Unguja Island. Many exporters and brokers visit those sites and buy dried *dagaa* products.

I met more than 10 exporters from the DRC. They all came from Lubumbashi, which is located in southeast DRC, near the border of Zambia. The exporters transport the *dagaa* from Zanzibar Town to Dar es Salaam by ferry, and then from Dar es Salaam to Lubumbashi via southern Tanzania and Zambia by truck. Brokers do not process the *dagaa* themselves; instead they have connections with exporters from the DRC. Brokers buy the dried *dagaa* from middlemen and sell them to the DRC exporters after adding their margin.

1. Fishing

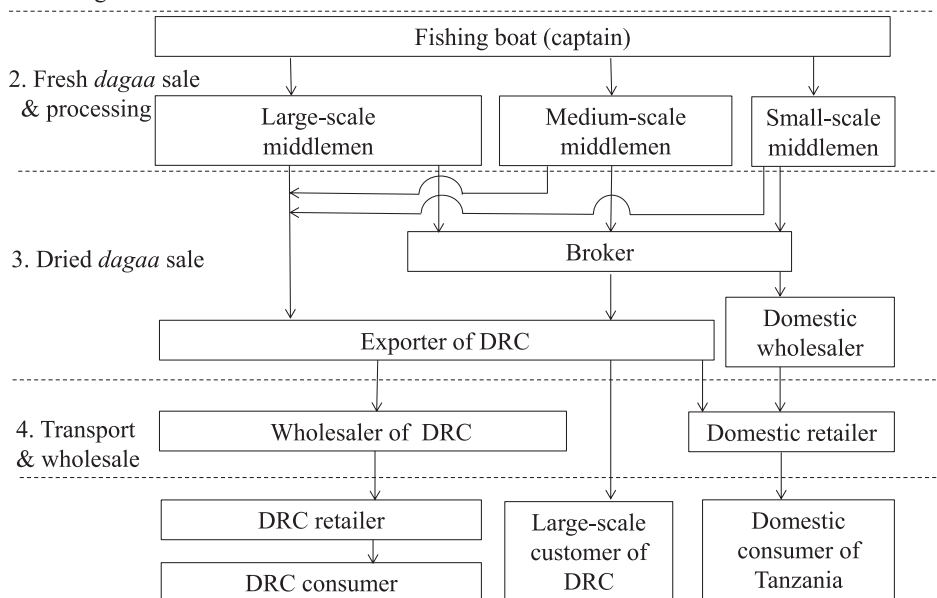


Fig. 2. Components of the *dagaa* industry.
Source) Field survey by author.

II. Production of dried-*dagaa*

1. Carrying

Fresh *dagaa* caught by fishermen are bought by middlemen and processed into dried *dagaa* at a landing and processing site. In the present study period (Aug.–Sep., 2013), fresh *dagaa* was sold by fishermen to middlemen for TZS 10,000 per 20-liter bucket. After the captain and middleman agree upon a price and quantity, the fresh *dagaa* are carried to the processing site, mainly by female workers (Photo 2). The workers come to the beach with their own 20-liter bucket and wait for the fishing boats. Because the beach in M village is shallow, the fishing boats land away from the coast. The women enter the sea with their clothes on, fill their bucket with *dagaa*, and then carry the bucket filled with *dagaa* on their head to the designated processing site. After dropping off the fresh *dagaa* at the processing site, they return to the fishing boats and repeat the process until all of the *dagaa* are delivered. On a big catch day, each person repeats this process more than 10 times.

2. Boiling

After the fresh *dagaa* arrive at the processing unit, they are boiled in hot salty water. This process is also performed by women. A huge pot made of iron sheets that can hold about 10 buckets of *dagaa* is used to boil the fish. Before the fresh *dagaa* arrive at the processing site, the workers are required to fill the huge iron

pot with water and boil it with firewood. The boiling process involves putting fresh *dagaa* in perforated plastic buckets and then submerging the buckets in the hot water (Photo 3). After boiling, the *dagaa* are removed, divided into small lots, and taken away to be sun-dried. This process is repeated until all of the *dagaa* have been boiled.

3. Sun-Drying

After cooling, the small lots of boiled *dagaa* are spread on a sheet to dry in the sun (Photo 4). This part of the processing is performed by men who prepare and maintain the drying area. During the dry season, sun-drying is completed in half a day, after which the dried *dagaa* are moved to a shed, called a “*banda*” in Swahili, which consists of some pillars and a roof made of palm leaves, for storage. However, during the rainy season this drying process takes longer, and when it rains the *dagaa* need to be covered with a tarp. If the *dagaa* are not dry within a day, they need to be put out to dry the next day. In the rainy season, it is important to ensure that the *dagaa* do not get wet in the rain.

4. Separating Fishmeal from Dried *Dagaa*

Dried *dagaa* is stored in *banda* until it is bought by brokers or exporters to the DRC. Before selling the dried *dagaa*, it has to be divided into fish-meal and dried *dagaa*. Dried *dagaa* consumers both domestic and abroad don’t like to eat the head of *dagaa* so it is removed before packing. To do this, the workers use sifters made of wooden frames and plastic nets to remove the head and any other particles, which is collected as fishmeal (Photo 5). Two men engage in the sifting work (Photo 6). The fishmeal is sold to poultry farmers from parts of mainland Tanzania such as Arusha, Moshi, and Dodoma.

5. Packing

After sifting the *dagaa*, the dried fish are packed into 154-kg sacks (Photos 7 & 8). The weight of the dried *dagaa* is measured by using a 20-liter bucket. A 20-liter bucket filled with dried *dagaa* weighs approximately 7 kg. Middlemen and exporters count the number of buckets of dried *dagaa* put into each sack. After reaching 22 buckets, the sack is sealed by sewing its opening with strings. During the study period (Aug.–Sep., 2013), the price of dried *dagaa* was TZS 3,400 per kg and that of fishmeal was TZS 600 per kg. Fishmeal is packed in a 120-kg sack measured in a similar manner. Packed *dagaa* sacks are loaded on the truck for shipment (Photo 9) and sent to the port of Zanzibar Town.

MIDDLEMEN IN M VILLAGE

I. Three Types of Middlemen

There are three types of middlemen in M village who buy fresh *dagaa* and process them to make dried *dagaa*, and they are characterized by the scale of their businesses (Fig. 2). Table 2 shows the characteristics of the three types of

middlemen who engage in the *dagaa* processing business in M village.

Most medium and small-scale middlemen are local residents of M village and they run their business using their own capital. In contrast, most large-scale middlemen come from outside M village, mostly Pemba Island, during the three weeks of each fishing period. The large-scale middlemen have financial backers with whom they operate the business. The backers provide the money to buy fresh *dagaa* and do not come to the *dagaa*-landing and processing sites.

The large-scale middlemen opened *dagaa* processing sites in the coastal area of M village and hire wage laborers for the processing work. The small-scale middlemen process their share of the *dagaa* at their home sites and operate their business with the help of family members. The medium-scale middlemen were once small-scale middlemen, but after increasing their capital, they opened their own processing sites on the beach. The medium-scale middlemen use hired laborers for processing the *dagaa*; however, they also use unpaid/paid family labor. Large- and medium-scale middlemen are able to use any land on the beach of the M village as long as it is not used by another middleman. When they open their own *dagaa* processing place, they cultivate the land, removing weeds and young mangrove trees. Table 3 shows the number of middlemen of each type observed in M village between August and September, 2013.

Table 2. The characteristics of the three types of middlemen

	Categories of middlemen		
	Large-scale	Medium-scale	Small-scale
Number of middlemen buying <i>dagaa</i> per day (in 20 L buckets)	50–100	10–30	< 10
Business funds	Funders	Own funds	Own funds
Hometown	Outsider	Most are M village	M village
Processing site	Coast area	Coast area	Home
Processing work	Wage laborer	Family and wage laborer	Family only

Source) Field survey by author.

Table 3. Number of middlemen of each type as observed in M village during Aug.–Sep., 2013

Place of residence	Categories of middlemen			Total
	Large-scale	Medium-scale	Small-scale	
M village	1	11 (2)	11 (9)	23 (11)
Unguja Island	5 (1)	3 (1)	0	8 (2)
Pemba Island	23 (1)	1	0	24 (1)
Unknown	3	0	0	3
Total	32 (2)	15 (3)	11 (9)	58 (14)

Source) Field survey by author.

Note) The numbers in parentheses are the numbers of females (internal number).

II. Role of Large-Scale Middlemen

The key actors of the *dagaa* processing industry are the large-scale middlemen who routinely buy more than 50 buckets (20 liters) of *dagaa*, and sometimes more than 100 buckets, a day. Mr. S, who established a *dagaa* processing business in M village, is one such large-scale middleman. Large-scale middlemen have strong relationships with the captains of particular *dagaa* fishing boats. When fishing for *dagaa*, the captains first call the large-scale middlemen to negotiate a price and inform them about the quantity of their catch. The captains and the large-scale middlemen agree on a price for the catch. Large-scale middlemen get priority in buying fresh *dagaa* from the fishing boats. This relationship between the captains and the large-scale middlemen is based on loans. When the fish catch is poor, captains have trouble maintaining their fuel expenses for fishing. On such days, the large-scale middlemen lend the captains enough cash to purchase fuel. The next morning, the captains bring their catch to the large-scale middlemen to repay the debt (Fujimoto, 2015).

The large-scale middlemen also have connections with exporters from the DRC, with whom they negotiate the price and quantity of dried *dagaa* over mobile phones. After the price and quantity are agreed upon, the exporters remit money from the DRC to the large-scale middleman and come to Zanzibar to collect the dried *dagaa*. The medium- and small-scale middlemen have no direct connection with the exporters from the DRC. Hence, they sell their products through the large-scale middlemen or brokers. The brokers who do not process *dagaa* by themselves but collect them from the middlemen in different fish-landing sites also sell them to the exporters. The large-scale middlemen and brokers take some margin from the other middlemen, usually TZS 100–200 per kg of dried *dagaa*. During the study period, dried *dagaa* was sold at TZS 3,400 per kg to exporters; therefore, medium- and small-scale middlemen sold their dried *dagaa* for TZS 3,200–3,300 per kg to large-scale middlemen or brokers.

WAGE SYSTEM AND NUMBER OF LABORERS IN THE *DAGAA* PROCESSING INDUSTRY IN M VILLAGE

Next, I will examine the wage system of the *dagaa* processing industry in M village. *Dagaa* processing is performed by the residents of M village. Table 4 shows the unit price for each wage stage of the processing work and the number of workers in M village engaged in each stage.

1. Payment for Unloading the Fresh *Dagaa*

In M village, 40 women engage in unloading the fresh *dagaa* from the boats. Among these 40 women, 26 are core workers who come to the beach every day during the fishing period. The remaining 14 women come to the beach only on big catch days. They are paid TZS 500–700 by the middlemen for every bucket of fresh *dagaa* they carry. The unit price changes depending on the distance from the fishing boat to the processing unit. This wage work is opportunistic work, in

Table 4. Wage works in the *dagaa* processing industry and the number of workers

Kinds of wage work	Sex	Wage (TZS)	Work pattern* ¹	Number of wage laborers
Carrying	F	500~700 TZS/bucket	Opportunistic	40* ²
Boiling	F	500 TZS/bucket	Fixed	79
Sun-drying & Sieving	M	400 (200 + 200) TZS/bucket	Fixed	79
Packing	M	3000 TZS/sack	Opportunistic	15* ³
Total				213

Source) Field survey by author.

Note) *1) Opportunistic mean not fixed employee. Anyone can work when they are in need of cash.

*2) Among 40 women, 26 are core members who come to beat to carry *dagaa* every day, the other members come to work only big catch day.

*3) Among 15 men, 10 are core members, the other occasionally join the work.

other words, anyone who wants to get cash on the day is free to join in this work.

2. Payment for Boiling

Large-scale middlemen hire two women to boil *dagaa* and pay them TZS 500 for each bucket of fresh *dagaa* boiled. Male medium-scale middlemen hire only one woman who works with the middlemen's wife or another family member. Female medium-scale middlemen hire only one woman and engage in the boiling work themselves with the wage laborer.

Some of the medium-scale middlemen pay a wage for family laborers whereas others do not. My research assistant, Mr. M, is a medium-scale middleman. At his *dagaa* processing unit his wife and another female worker engage in this boiling work. He pays wages to both the hired worker and his wife. These two female workers are paid a total of TZS 500 per bucket of fresh *dagaa* they process; therefore, each woman gets TZS 250 per bucket.

3. Payment for Sun-Drying and Sieving

Sun-drying is also performed by wage laborers, for which large-scale middlemen and female medium-scale middlemen hire two men, whereas male medium-scale middlemen hire one man for TZS 200 per bucket of fresh *dagaa* processed and engage in the sun-drying process themselves together with the laborer.

As mentioned above, before packing, the fishmeal needs to be separated from the dried *dagaa*. Two men engage in this sifting work and are paid TZS 200 per bucket of fresh *dagaa* they process. This sifting work is performed by the same laborers who engage in the sun-drying process. Large-scale middlemen and female medium-scale middlemen hire two men. Hence, the wage laborers who engage in the sun-drying and sieving process gets a total of TZS 400 per bucket of fresh *dagaa* processed. Medium-scale middlemen hire only one person for sun-drying, so sometimes the middlemen themselves engage in this sifting work with the wage laborer. Other times, sun-drying laborers employed by a different medium-scale middlemen cooperate with each other and share their wages.

ECONOMIC IMPACT OF THE *DAGAA* PROCESSING INDUSTRY IN M VILLAGE

I. Scale of the *Dagaa* Processing Industry in M Village

To reveal the economic impact of the *dagaa* processing industry on the people of M village, I determined the employment and cash income generated from the *dagaa* industry in the village. I collected *dagaa* catch data of M village on a daily basis from August 2012 to the present time, 2017. I asked my research assistant, Mr. M, to note the number of fishing boats coming into M village, the number of buckets of *dagaa* unloaded, and their daily prices. As he goes to the beach to buy fresh *dagaa* for his own business, the information he collected is also useful to him. For the fishing period from August to September, 2013, 7,933 buckets of fresh *dagaa* were bought and processed in M village. The price of a bucket of fresh *dagaa* ranged from TZS 7,000 to 12,000, with an average price of about TZS 10,000. Table 5 presents the cash earning activities that were created by the *dagaa* processing industry.

Between August and September 2013, exporters and brokers purchased 264 sacks of dried *dagaa* and 154 sacks of fishmeal. Gross sale for the middlemen (l + m in Table 5) was TZS 149,318,400 (USD 91,494). Although this entire amount did not directly benefit M village, it is noteworthy that the newly raised *dagaa* industry creates thus value added products here. Certainly, a large part of this gross sale is profits to the large-scale middlemen who do not live in M village, but part of their profit will become the working capital of the *dagaa* industry in the following months, which will consequently benefit the local people.

II. Significance of Cash Earning from the *Dagaa* Industry in M Village

The total wage earnings (including the amount of unpaid family laborers by medium-scale middlemen) created by the *dagaa* processing industry reached TZS 12,796,200 (USD 7,820). Before the *dagaa* processing industry was established in 2010, there were very few cash-earning opportunities in M village. Many villagers said that before the *dagaa* industry started, many men engaged in subsistence agriculture and irregular wage labor such as construction work. When there was no wage labor, most men had no option but to engage in subsistence agriculture, and most women engaged in subsistence agriculture and domestic work. Therefore, the *dagaa* processing industry has had a large economic impact on this area.

During the study period, 213 local people (no duplicates) were engaged in *dagaa* processing wage work in M village (Table 4) and 23 M-village residents participated in the *dagaa* processing business as middlemen (Table 3). A total of 236 people received a cash income from the *dagaa* processing industry. The population of people over 20 years of age in M village was 473 and the number of households was 194. Therefore, approximately 50% of the adults received cash-earning opportunities from the *dagaa* processing industry, and on average one or two adults in each household are engaged in it.

The total wages earned from *dagaa* processing work per month is TZS 12,796,200

Table 5. Industrial scale for a fishing season between Aug.–Sep., 2013 in M village

Industrial scale for one fishing season (Aug.–Sep., 2013)		Total
a) <i>dagaa</i> catch (Number of 20 L buckets)		7,933
b) Number of buckets processed by paid workers* ¹	95% of a	7,536
c) Number of 154 kg dried <i>dagaa</i> sacks* ²	a/30	264
d) amount of fish meal (kg)* ³	c × 70 kg	18,480
e) Number of 120 kg fish meal sacks* ³	d/120	154
Wage for <i>dagaa</i> processing work		
f) wage for carrying a bucket of fresh <i>dagaa</i> * ⁴	a × 600	4,759,800
g) wage for salt boiling a bucket of fresh <i>dagaa</i> * ⁵	b × 500	3,768,000
h) wage for sun drying a bucket of boiled <i>dagaa</i> * ⁵	b × 200	1,507,200
i) wage for separating <i>dagaa</i> and fish meal (sieve)* ⁵	b × 200	1,507,200
j) wage for packing dried <i>dagaa</i>	c × 3,000	792,000
k) wage for packing fish meal	e × 3,000	462,000
Subtotal		12,796,200
Gross sales for middlemen		
l) selling price of dried <i>dagaa</i> (TZS)	3,400/kg × c × 154	138,230,400
m) selling price of fish meal (TZS)	600/kg × d	11,088,000
Subtotal		149,318,400

Source) Field survey by author.

Note) *1) A few portions of fresh *dagaa* are processed by small-scale middlemen without wage laborers. I estimated 5% of fresh *dagaa* landed in M village was purchased and processed by small-scale middlemen.

*2) 30 buckets of fresh *dagaa* yield a 154 kg sack of dried *dagaa*. The amount of c) includes *dagaa* processed by small-scale middlemen.

*3) A sack of dried *dagaa* (154 kg) produces about 70 kg of fish meal.

*4) The price for carrying fresh *dagaa* to the processing site is TZS 500–700 depending on the distance to the processing site. According to my calculation, it is TZS 600.

*5) The total wage of boiling (g), sun-drying (h), and sieving (i) works includes unpaid amount of family laborers.

(USD 7,840) (Table 5). Under the assumption that all 194 households in M village are involved in the industry, each household gets an average of TZS 65,960 (USD 40.4) per month. In rural Zanzibar, monthly mean and median per adult equivalent consumption expenditure were TZS 67,842 (USD 41.6) and TZS 58,649 (USD 35.9), respectively, in 2014/15 (OCGS, 2016). Thus, the cash income created by the *dagaa* industry contributes substantially to the income of the people in M village.

III. Secondary Effects of the *Dagaa* Processing Industry on the People of M Village

1. Contribution to Food Security

The *dagaa* processing industry has created not only income-generating oppor-

tunities for the people of M village, but it has also had other secondary effects. As mentioned above, there were no fish-landing sites or fish markets in M village and people had trouble finding sources of protein for their daily meals. Some days they went to the beach on foot to collect shellfish or small fish, and on other days they bought fresh fish with cash from fish vendors who traveled from Mkokotoni. Occasionally, they would go to Mkokotoni by bus to buy fish. Now, however, the *dagaa* industry provides people with a daily source of protein. Many *dagaa* fishing boats come to M village to sell fresh *dagaa* and they also bring other kinds of bycatch. When the fishermen put the fresh *dagaa* into the buckets, they put other kinds of fish or squid in there also. This bycatch is taken by the carrying workers. Even if there is no bycatch, the fishermen and middlemen give the workers some fresh *dagaa* for meals. People who engage in the processing work can also take some fresh *dagaa* for their daily meals at home. The middlemen themselves also use fresh *dagaa*, or mixed *dagaa* and bycatch, as part of their daily meals at home. Even during the non-fishing period when the middlemen stop production, dried *dagaa* is available for use as a protein source in side dishes. Thus, many female workers receive both a cash income and a source of food from their job, which are important secondary benefits.

2. Stabilization of Household Budgets

The second effect the *dagaa* industry has had on the residents of M village is related to stabilizing household budgets. There are some microfinance groups, such as the rotating savings and credit associations called SACCOS (Savings and Credit Cooperative Societies)⁽³⁾ and VICOBA (Village Community Bank),⁽⁴⁾ where members can deposit specific amounts of money every week or every month to save for the future. SACCOS in M village started in 2007 with 35 women and by 2014 there were 53 members of both sexes. VICOBA started in 2014 and there are now at least three groups with approximately 30 members each. People who engage in the *dagaa* industry said that these microcredit groups promote wage labor and *vice versa*. When members need money for emergencies or to start a new business, they can borrow money from these microfinance groups. After the establishment of the *dagaa* processing industry, these microfinance groups became very active, providing people with opportunities to engage in other economic activities. Thus, income improvement provides the people of M village with the potential to advance their economic activities and livelihood.

3. Benefits from the *Dagaa* Fishing Cycle and Working Hours

The income-earning opportunities provided by the *dagaa* industry are an advantage for the people of M village. As *dagaa* fishing is carried out for only three weeks a month, people can engage in other economic or household activities during the 10 non-fishing days. Moreover, the *dagaa* are landed only in the morning so the carrying workers can finish their work in the morning. The boiling workers need to work for 3 to 4 hours a day, and even when the *dagaa* catch is very big they can go home between 12 and 1 pm at the latest. Therefore, these female workers can engage in subsistence agriculture or other household activities, such as gathering fire wood, cooking, and caring for their children, after they

finish their work *dagaa* processing work. Thus, although they need to work harder than before the *dagaa* industry was established, the *dagaa* industry provides them not only with a cash income but also with a daily source of protein, which saves them the need to search for food themselves along the beach.

The male workers, who are engaged in sun-drying, need to remain at the *dagaa* processing site for a short time during the dry season. During the rainy season, they need to stay for a longer time to watch the *dagaa* and ensure that they do not get wet, but they can cooperate with other sun-drying workers employed by different middlemen so that all of the sun-drying workers do not always need to be on-site. Therefore, these workers can also engage in other activities after their work at the *dagaa* processing site is finished. Even if they are obliged to limit other economic activities and/or leisure time, it may be beneficial for them to take jobs within the *dagaa* industry.

CONCLUSION

Here, I described the structure of the budding *dagaa* processing industry in Zanzibar. Nearly 50% of the adult populations in M village are employed in the new industry. Even assuming that all households in M village get cash earning opportunities from the industry, those incomes are rather large for the local area. It therefore accounts for a substantial proportion of their monthly living expenses, as determined by comparison with household budget survey data.

However, the present study period was only one month (Aug.–Sep., 2013). In M village, the fish catch fluctuates across seasons: May to September is a good fishing period, December to April is a poor fishing period, and October and November are a moderate fishing period. As such, wage work and cash income from this industry may decline during the poor and moderate fishing periods. However, *dagaa* fishing is carried out throughout the year. Therefore, even if the fish catch and income earnings decrease, people can receive some cash income from the *dagaa* industry all year round. Moreover, in the poor and moderate fishing periods, they can engage in other economic activities with their savings or with loans from the microfinance groups that have been established in parallel with the *dagaa* industry.

It is important to note that although there are no fisherwomen on the *dagaa* fishing boats, the *dagaa* processing industry provides cash earning opportunities for both men and women. In many rural African societies, women have fewer cash earning opportunities than men, which was the also case in M village before 2010. In Zanzibar, income poverty is a serious problem for many people and accessibility to food depends largely on cash income. Thus, the *dagaa* processing industry in M village ensures both income generation and food security.

ACKNOWLEDGEMENTS I greatly appreciate the Ministry of Education, Science, Sports, Culture and Technology of Japan and the Japan Society for the Promotion of Science to fund this study. This publication was supported by Grand-in-Aid for Scientific Research

Project, No. 25257107 of 2013 headed by Jun IKENO). My field work for this study was supported by Grant-in-Aid for JSPS Research Fellow (No. 12J04503 to Mariko FUJIMOTO), and JSPS Grant-in-Aid for Scientific Research (No. 15H02601 to Ichiro IMAI; No. 24251005 to Ueru TANAKA). The identification of *dagaa* species was supported by Professor Akihisa Iwata at Kyoto University. I grateful to Tanzania Commission for Science and Technology (COSTECH), and Zanzibar Commission for Science and Technology (COSTECH, Zanzibar), Office of Chief Government Statistician, Zanzibar (OCGS), Regional Office of North Unguja, and all residents who are concerned to allow me to conduct research in Zanzibar.

NOTES

- (1) In this article, the term “village” is used as the translation of “*shehia*,” which is the official minimum administrative unit in Zanzibar, even though this word is usually translated as “ward” in English.
- (2) Exchange rate on August 1, 2014: USD 1 = TZS 1,632 = JPY 102.2 using the OANDA historical rate converter (Accessed July 25, 2017) (<https://www.oanda.com/fx-for-business/historical-rates>).
- (3) SACCOS (Savings and Credit Cooperative Organization Societies) are microfinance associations introduced by non-governmental organizations based on the Cooperatives Societies Act, 1991.
- (4) VICOPA (Village Community Bank) was established by the Social and Economic Development Initiatives of Tanzania in 2002. The model was copied from a similar model established in Niger.

REFERENCES

- Barret, C.B., T. Reardon & P. Webb 2001. Non-farm income diversification and household livelihood strategies in rural Africa: Concepts, dynamics, and policy implications. *Food Policy*, 26(4): 315–331.
- Béné, C. 2003. When fishery rhymes with poverty: A first step beyond the old paradigm on poverty in small-scale fisheries. *World Development*, 31(6): 949–975.
- Brashares, J.S., P. Arcese, M.K. Sam, P.B. Coppolillo, A.R.E. Sinclair & A. Balmford 2004. Bushmeat hunting, wildlife declines, and fish supply in West Africa. *Science* 306: 1180–1183.
- Ellis, F. 2000. *Rural Livelihoods and Diversity in Developing Countries*. Oxford University Press, Oxford.
- Food and Agriculture Organization, United Nations (FAO). 1985a. *Field Guide Commercial Marine and Brackish Water Species of Tanzania*. Online. <http://www.fao.org/3/a-r7066e.pdf> (Accessed July 14, 2015).
- 1985b. *FAO Species Catalogue VOL. 7. CLUPEOID FISHES OF THE WORLD (suborder CLUPEOIDEI), Part 1. Chirocentridae, Clupeidae and Pristigasteridae*.
- 1988. *FAO Species Catalogue VOL. 7. CLUPEOID FISHES OF THE WORLD (suborder CLUPEOIDEI), Part 2. Engraulididae*.
- Fujimoto, M. 2015. Structure of the *dagaa* industry in Zanzibar, Tanzania: Economic activities among the several actors linking production and consumption areas (in Japanese with English abstract). *Africa Kenkyu*, 87: 37–49.
- International Trade Centre (ITC). *TRADE MAP*. Online. <http://www.trademap.org/> (Accessed

- July 14, 2017).
- Jazairy, I., M. Alamgir & T. Panuccio 1992. *The State of World Rural Poverty: An Inquiry into Its Causes and Consequences*. New York University Press, New York.
- Kimura, D., H. Yasuoka & T. Furuichi 2012. Diachronic changes in protein acquisition among the Bongando in the Democratic Republic of the Congo. *African Study Monographs Supplementary Issue*, 43: 161–178.
- Komatsu, K. & K. Kitanishi 2015. Household protein intake and distribution of protein sources in the markets of southern Ghana: A preliminary report. *African Study Monographs Supplementary Issue*, 51: 157–173.
- National Bureau of Statistician (NBS), Tanzania & Office of Chief Government Statistician (OCGS), Zanzibar 2013. *2012 Population and Housing Census: Population Distribution by Administrative Area*. The United Republic of Tanzania.
- Office of Chief Government Statistician (OCGS), Zanzibar 2016. *Household Budget Survey 2014/15*. OCGS, Zanzibar.
- Oishi, T. & M. Hagiwara 2015. A preliminary report on the distribution of freshwater fish of the Congo River: Based on the observation of local market in Brazzaville, Republic of the Congo. *African Study Monographs Supplementary Issue*, 51: 93–105.
- Revolutionary Government of Zanzibar (RGoZ) 2007. *Zanzibar Strategy for Growth and Reduction of Poverty (ZSGRP)*. RGoZ, Zanzibar.
- 2014. *Zanzibar Fisheries Policy (First draft prepared with the support of SmartFish)*. RGoZ, Zanzibar.
- Smith, M.M. & P.C. Heemstra 1986. *Smith's Sea Fishes*. Springer, Berlin.

——— Accepted November 30, 2017

Author's Name and Address: Mariko FUJIMOTO, *Graduate School of Asian and African Area Studies, Kyoto University, 46, Shimoadachi-cho, Yoshida, Sakyo-ku, Kyoto 606-8501, JAPAN.*

E-mail: fujimoto [at] jambo.africa.kyoto-u.ac.jp



Photo 1. *Dagaa tonge kwa tonge* (15/Aug./2013).



Photo 2. Women carry fresh *dagaa* to the processing site (17/Mar./2013).



Photo 3. Woman boiling *dagaa* in a big pot (28/Feb./2014).



Photo 4. Man dispersing *dagaa* on the sheets for sun-drying (25/Aug./2014).



Photo 5. Sifter to separate fishmeal from dried *dagaa* (21/Feb./2013).



Photo 6. Men sifting dried *dagaa* (26/Aug./2014).



Photo 7. Men packing dried *dagaa* into sacks (15/Aug./2013).



Photo 8. Sack with 154 kg of dried *dagaa* (13/Mar./2013).



Photo 9. Shipment of the dried *dagaa* sacks from M village (20/Mar./2013).