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GHANA/NETHERLANDS ARTISANAL FISH PROCESSING PROJECT

RESEARCH PROJECT #9

STUDIES ON THE TRADITIONAL STORAGE OF SMOKED ANCHOVIES IN GHANA

PROGRESS REPORT #1 (PHASE TWO)

TRADITIONAL STORAGE OF SMOKED ANCHOVY (*Anchoa guineensis*) AT AKPLABANYA

By

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November 1992

ACKNOWLEDGEMENT

This project was undertaken with funds provided by the Governments of Ghana and the Netherlands under the Ghana - Netherlands Artisanal Fish Processing Project. The authors wish to acknowledge the assistance given by the fish processing community at Akplabanya, in the Greater Accra Region of Ghana, during the survey to establish the structural characteristics and techniques involved in the traditional storage of anchovies in the village.

STRUCTURAL CHARACTERISTICS OF TRADITIONAL ANCHOVY STORAGE AT AKPLABANYA

G. Nerquaye-Tetteh and W. A. Plahar

ABSTRACT

The different techniques used for the traditional storage of smoked anchovies by artisanal fish processors at Akplabanya (a coastal fishing village near Ada, in the Greater Accra Region of Ghana) were studied, and the major structural features, material requirements and methods of construction were determined. Three major types of smoked anchovy storage structures were identified. These include: (a) The round oven storage structure, (b) The sea-sand platform storage structure, and (c) The fenced yard structure. In general, all the structures are built with mainly locally available materials; and the choice of any of the three depends on factors such as capital input available and the volume of smoked fish to be stored. The duration of storage depends, to a large extent, on the period of time the processor can afford to lock up the capital invested. It also depends on the demand and current market value. Generally however, such traditional storage is undertaken for a period ranging between four and seven months. The paper gives a detailed description of the three different techniques, the structural material requirements as well as step wise procedure for their installation. Pictorial illustrations are also provided. The structural characteristics established in this study for the round oven technique were used to construct a proto-type structure in the village to determine its effectiveness in preserving the quality of smoked anchovies.

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INTRODUCTION

The remarkable increases in anchovy landings in recent years are indicative of its increasing economic and nutritional significance in Ghana and neighbouring West African countries. Anchovies (Anchoa guineensis) are used for direct human consumption in the preparation of adult and weaning foods, and also as a main source of protein in the animal feed industry. Among the various traditional processing methods employed in Ghana to preserve fish, smoking and sun drying are the most widely used techniques for anchovies. The development of improved versions of the traditional fish smoking ovens, and the successful extension and adoption of the improved smoking techniques in many fish processing communities have further enhanced the popularity of smoking as a major fish preservation method in Ghana (Kagan, 1969; 1970; Nerquaye-Tetteh, 1989).

The advantages of the improved ovens in terms of increasing smoking capacity , fuel economy and a better quality product have been adequately demonstrated in training programmes under the Regional Training and Applied Research Project on Artisanal Fish Processing in West Africa (under the Ghana/Netherlands collaborative fish project). In fact, it was during one of such training programmes at Tema Manhean that the socio-economic significance of smoked anchovy production and the need for research into its storage problems were identified.

Large scale smoking and marketing of anchovies are undertaken in Ghanaian coastal fishing villages like Tema Manhean and Akplabanya in the Greater Accra Region of the country. The bulk of the smoked fish has to be stored for several months for

distribution during the off-season.

In general, very little has been done to assess, for the purposes of preventing, post-processing losses and general quality deterioration of smoked fish during storage. Apart from recent studies under the Ghana/Netherlands Artisanal Fish Processing and Applied Research Project no other studies have been undertaken on the traditional storage of smoked anchovies in particular. The situation can be explained mainly on account of the fact that large scale processing and storage of anchovies is a recent development in response to increased production and utilization for human consumption and animal feed.

An approved research project under the Ghana/Netherlands Artisanal Fish Processing Project seeks to study the traditional storage of anchovies in Ghana in order to assess its effectiveness in preserving the quality of the smoked fish over a period of time. The first phase of the project dealt with the traditional storage of smoked anchovies at Tema Manhean, a coastal fishing village near Accra. Reports were submitted on the structural characteristics of the traditional storage as well as the physical, chemical, microbiological and mycotoxicological changes during short-term and long-term traditional storage of smoked anchovies at Tema Manhean. (Nerquaye-Tetteh and Plahar, 1992; Plahar, 1992; Hodari-Okae and Kpodo, 1992; Plahar, et al. 1992a; Plahar, et al. 1992b.).

The second phase of the project deals with studies on the traditional storage of smoked anchovies at "Akplabanya", another major fish processing village. "Akplabanya" is located near Ada, in the Greater Accra Region of Ghana. The aspect of the project

in this progress report deals with a detailed study of the structural characteristics of the traditional storage techniques used by the artisanal fish processors. It also provides pictorial illustrations of the different stages involved in the construction of selected traditional anchovy storage structures.

2. MATERIAL REQUIREMENTS FOR THE CONSTRUCTION OF SMOKED ANCHOVY STORAGE STRUCTURES

In general, three types of traditional storage structures are known to be in use for smoked anchovy storage at Akplabanya. The survey conducted into the structural characteristics of these storage methods were able to identify the major material requirements and the sources of procurement by the processors. Traditional smoked anchovy processors at Akplabanya make use of mainly locally available materials in the construction of all the storage structures. The following sections give a list and description of basic materials required for setting up a smoked anchovy storage structure at Akplabanya:

2.1. Materials for the Round Oven Storage Structure

a. Clay

Local clay is required for the construction of a traditional round oven which forms the base of the storage structure. The clay is mixed with water and kneaded well into a semi-solid smooth mouldable consistency. In many traditional set ups in the area, this type of clay is the only material available for building houses.

b. Cut Logs

Pieces of about 7.0 cm diameter logs are acquired and cut to traverse the base length of the structure. Only a few of such pieces are required to provide the needed base

support of the structure.

c. Mesh Wire

One-half or three-quarter inch mesh wire is required for the base of the oven. This material is manufactured locally in Ghana and could be purchased by the processors. Incidentally, the same type of mesh is used by the fish smokers in the construction of the smoking trays as part of the improved smoking ovens.

d. Twine or Rope for Mid-section Support

In the previous study at Tema Manhean, it was observed that several pieces of small sticks (about 1.5 cm thick) cut to equal lengths of about 105 cm were required to weave a netting to form a strong support for the mid section circumference of their traditional storage structure. At Akplabanya, only ordinary ropes are used to tie round the mid section beyond the height of the oven to support the structure. The type of rope or twine used is available locally for purchase from mainly old folks who produce it as a pass-time engagement.

e. Brown Paper Lining and Polyethylene Material Cover

Pieces of brown paper required to line the bottom and sides of the structure. A large sheet of black polyethylene material is also required to cover the whole structure to protect it from rain and dust.

f. Baskets

About eight small baskets 20 cm high with 30 cm and 10 cm open end and bottom diameters respectively are required for top protective covering of the structure.

2.2. Materials for Sea-Sand Platform Storage

a. Cement Blocks

Five-inch thick cement blocks are used to make a wall of about three layers of block arranged flat on each other without mortar. Usually about thirty pieces of such blocks are required for constructing only one side of a square platform.

b. Sea sand

Clean sea sand from the near-by beach is used to fill the platform base to the height of the block level. It is very important that the sand is clean and free of any garbage matter.

c. Jute Sacks and Brown Paper

Several jute sacks are needed to cover the sandy platform. Old cocoa or maize bags are suitable for the purpose. The sack layer is also covered with a layer of brown paper. Locally, the middle and outer layers of cement bags are used to avoid contamination with cement. More jute sacks are also needed to cover the top of the storage structure.

d. Polyethylene Material

A large sheet of black polyethylene material is required for use in covering the whole structure for protection against rain and dust. This material is obtainable from a manufacturing company, "Poly Sacs" Company, Ghana Ltd. in Accra.

e. Baskets

About eight small baskets 20 cm high with 30 cm and 10 cm open end and bottom diameters respectively are required for top protective covering of the structure.

2.3. Materials for the Fenced Yard Storage Structure

a. Sticks for Fencing

Several sticks measuring about 2m long are obtained locally from young nim trees or similar species of trees in the area. The sticks must be strong and flexible enough to facilitate weaving them together into a strong netting.

b. Polyethylene Material

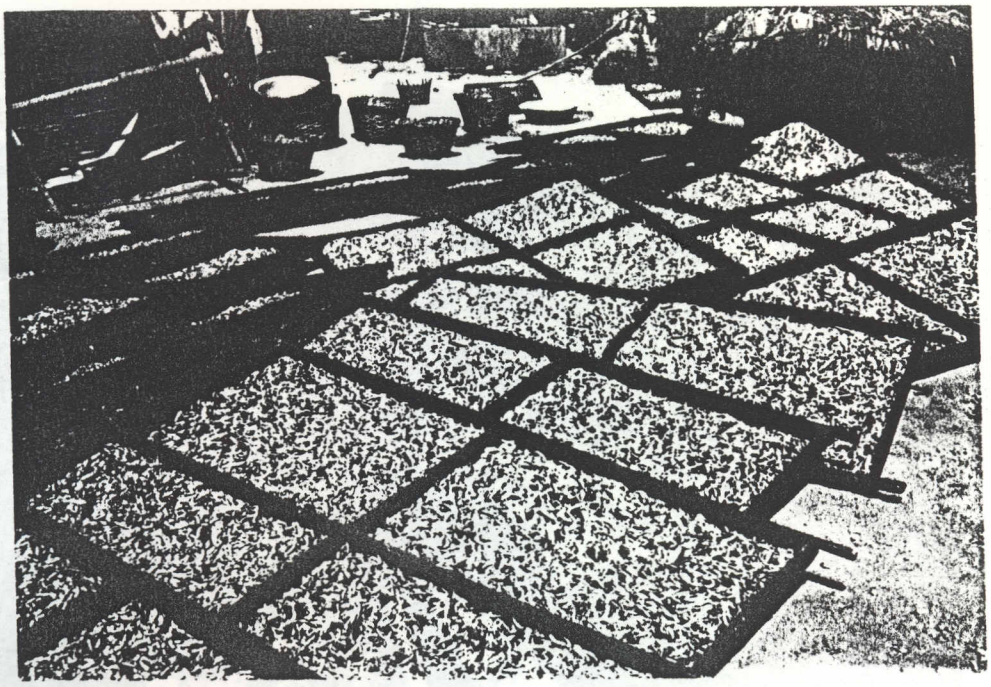
A large sheet of black polyethylene material is required for use in covering the whole structure for protection against rain and dust. This material is obtainable from a manufacturing company, "Poly Sacs" Company, Ghana Ltd. in Accra.

2.4. Preparation of Anchovies for Storage

Anchovies for storage are either sun-dried or smoked. These constitute the two main processing techniques used for fish preservation at Akplabanya. Of these, smoking or more appropriately, smoke-drying is employed for long-term preservation of anchovies. The newly introduced improved smoking kiln, the "chorkor smoker" is used by all large-scale anchovy processors in the village in their smoking activities.

Freshly landed anchovies are purchased and prepared for smoking by washing and surface-drying. Surface-drying is carried out by spreading the fish on the smoking trays (Fig 1). The trays are left in the sun for several hours after which they are arranged on the smoking oven for the smoke-drying process (Fig 2). Earlier reports by the fish research team at the Food Research Institute provide detailed description and evaluation of the smoking process by the "Chorkor Smoking Oven" technique (Nerquaye-Tetteh, 1979).

When ready for storage, the smoked anchovies are conveyed in large baskets to the storage site by children who receive some token remuneration for their services (Fig 3). No matter the temptation, chewing of the product, and eating in general is prohibited while the fish is being conveyed or packed for storage. Eating while conveying or packing the smoked fish for storage is believed to cause early infestation and spoilage.



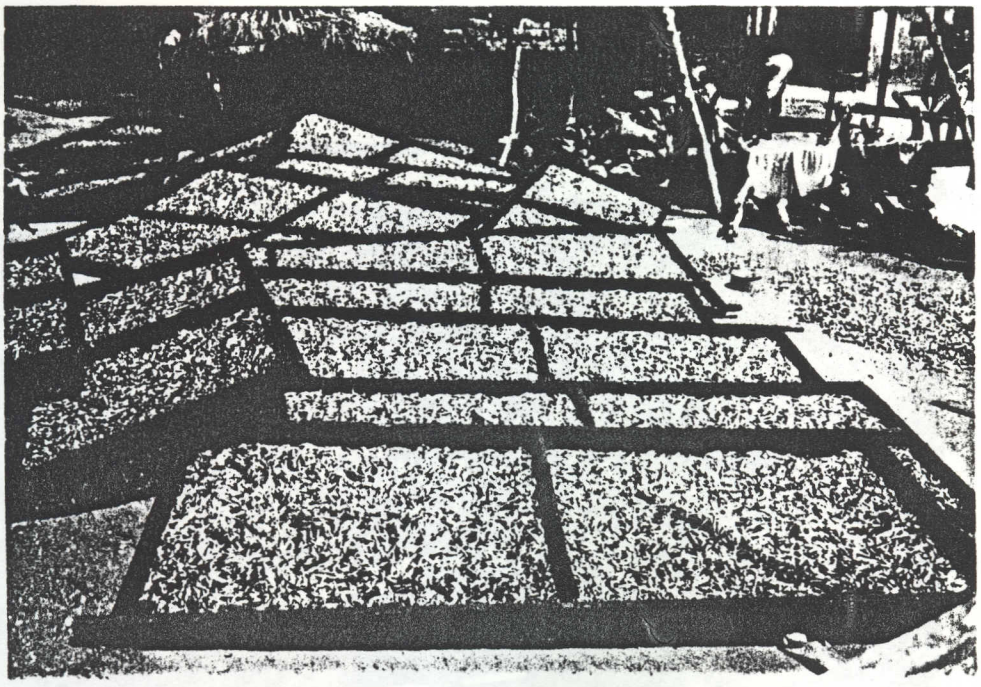


Fig 1. Trays of Anchovies being prepared for smoking.

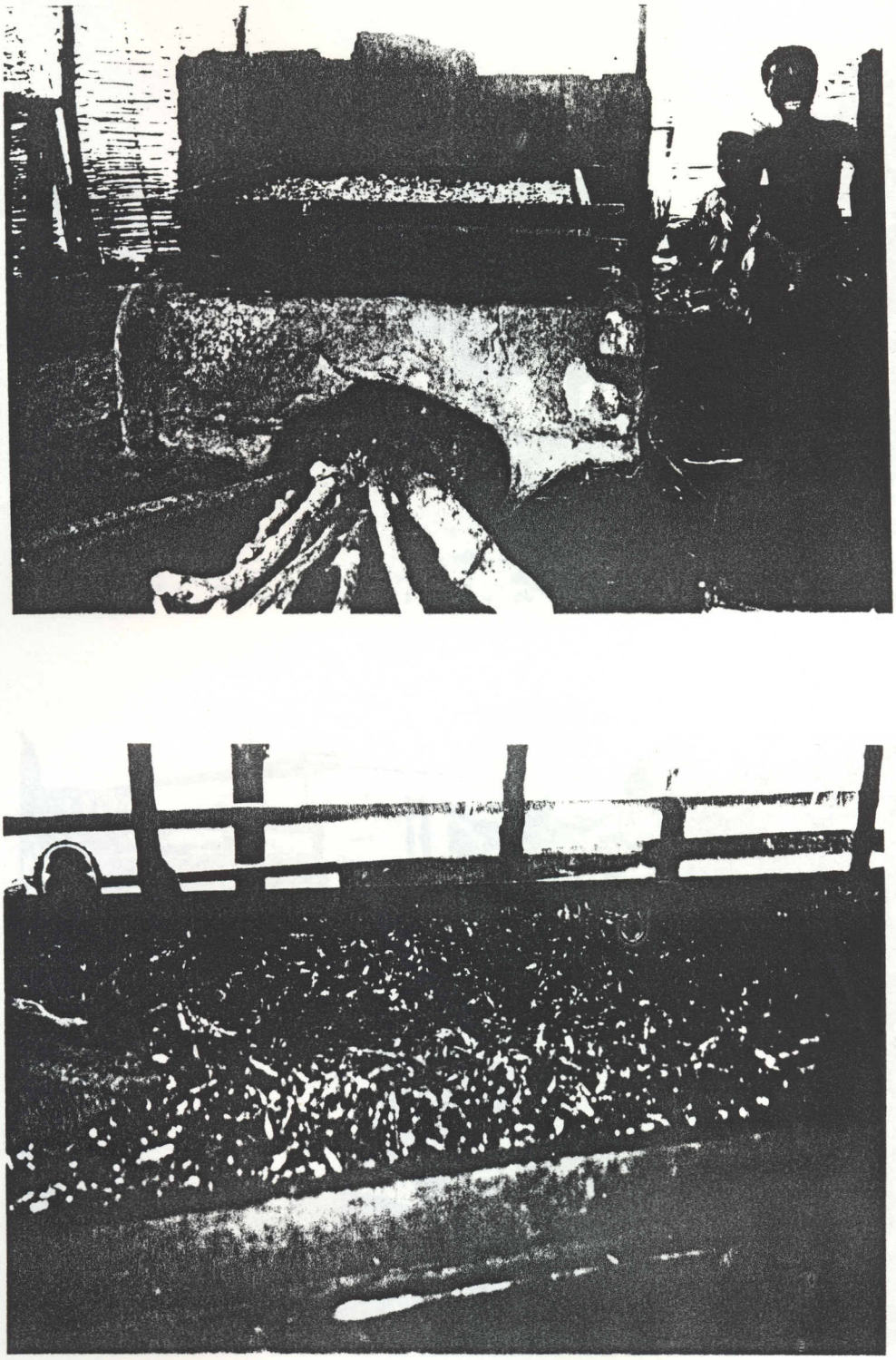


Fig 2. Smoking of Anchovies in progress

Fig 3. Smoked anchovies being conveyed to storage site

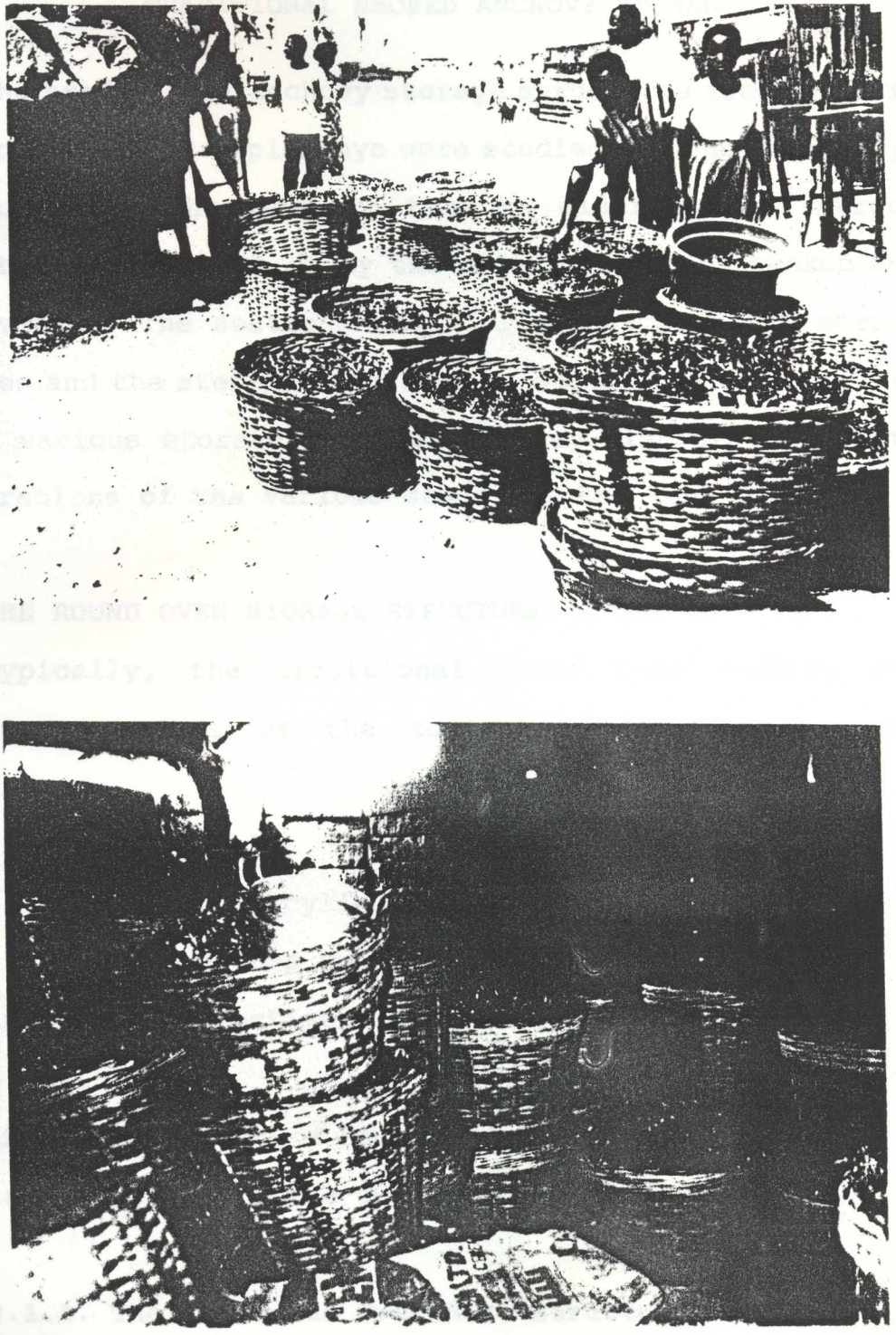


Fig 4. Smoked Anchovies ready for packing into storage

3. STRUCTURAL FEATURES AND CONSTRUCTION OF TRADITIONAL SMOKED ANCHOVY STORAGE

The traditional anchovy storage structures used by artisanal fish processors at Akplabanya were studied and one proto-type was constructed by the Research team to elucidate the structural characteristics and to study the effectiveness of smoked anchovy preservation. The sections that follow describe the structural features and the step-wise procedure employed in the construction of the various storage structures. They also provide pictorial illustrations of the various stages of the construction.

3.1. THE ROUND OVEN STORAGE STRUCTURE

Typically, the traditional Round Oven anchovy storage structure consists of the following identifiable parts or sections:

a. A round (cylindrical) mud oven base
b. A dome top section
and c. A protective top covering

A detailed description of each of these identifiable parts of the structure is given in the sub-sections that follow.

3.1.1. The Round Mud Oven Base Structure

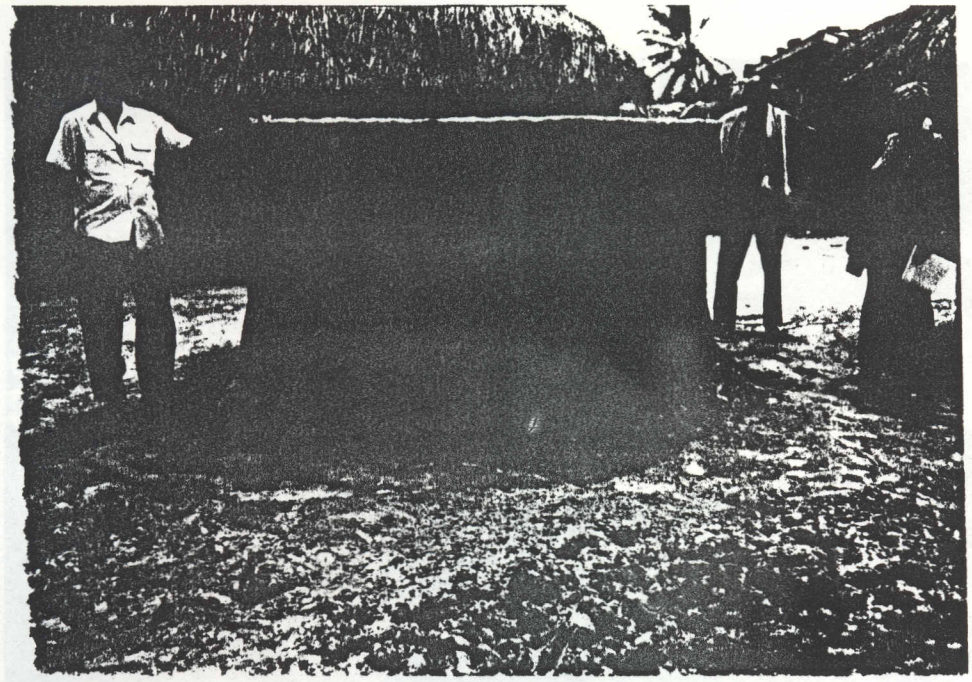
The base structure is made up of a hardcore base support constructed almost a meter above ground level inside a round mud oven. The traditional round oven forms the base housing for the whole storage structure. The oven is

constructed with clay that have been thoroughly kneaded into a smooth and mouldable consistency. The oven is always constructed a few weeks in advance for it to dry well before it is used for storage.

The size of the oven base structure varies depending on the desired storage capacity by the processor. A typical storage oven shown in Fig 5, is 1.2m high with a top circumference of 8.3m. The top circumference tapers down slightly to a mid-section and base circumference of 8.0m. The slight indentation of the circumference is at a distance of 0.4m from the top level of the oven. This is to facilitate the construction of the hardcore platform base at that depth in the oven for the smoked fish to be loaded on.

With this arrangement, a hollow space of about 0.8m from ground level up, is created inside the oven beneath the loading level. Since the oven does not have any opening at the base, the hollow space created retains a relatively stagnant air throughout the storage period. According to the processors interviewed, air circulation enhances spoilage and is undesirable in the oven method of smoked anchovy storage.

The hardcore base support platform on which the smoked fish to be stored is dumped is built with a layer of 7.0 diameter cut logs arranged horizontally to cover the entire inside base diameter of the oven (Fig 6). The wooden platform is then covered with mesh wire. In addition to providing a solid foundation for holding the weight of the



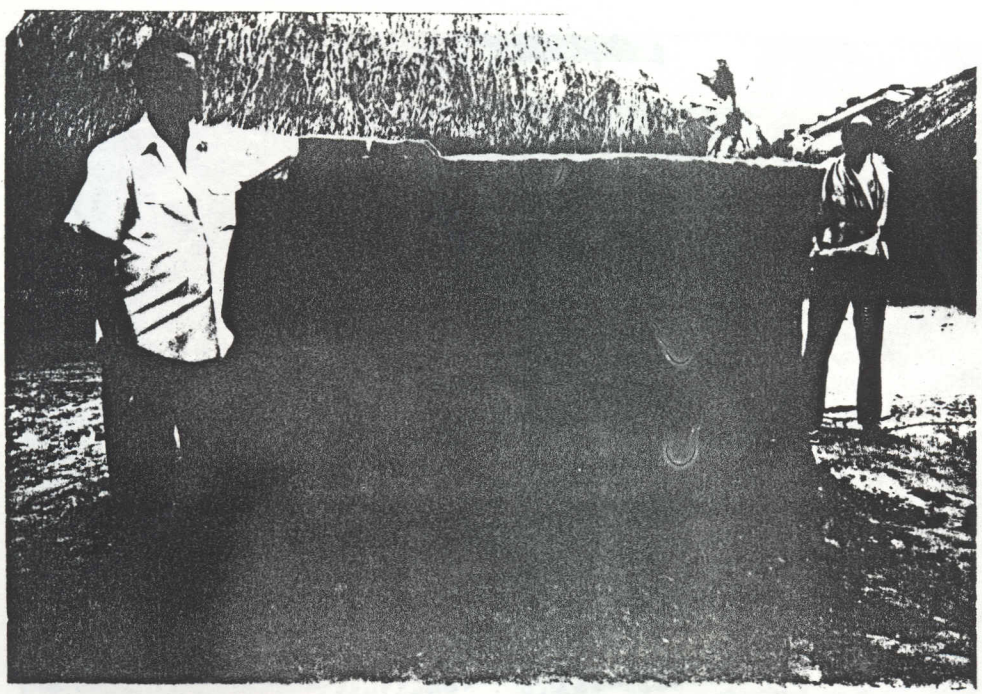
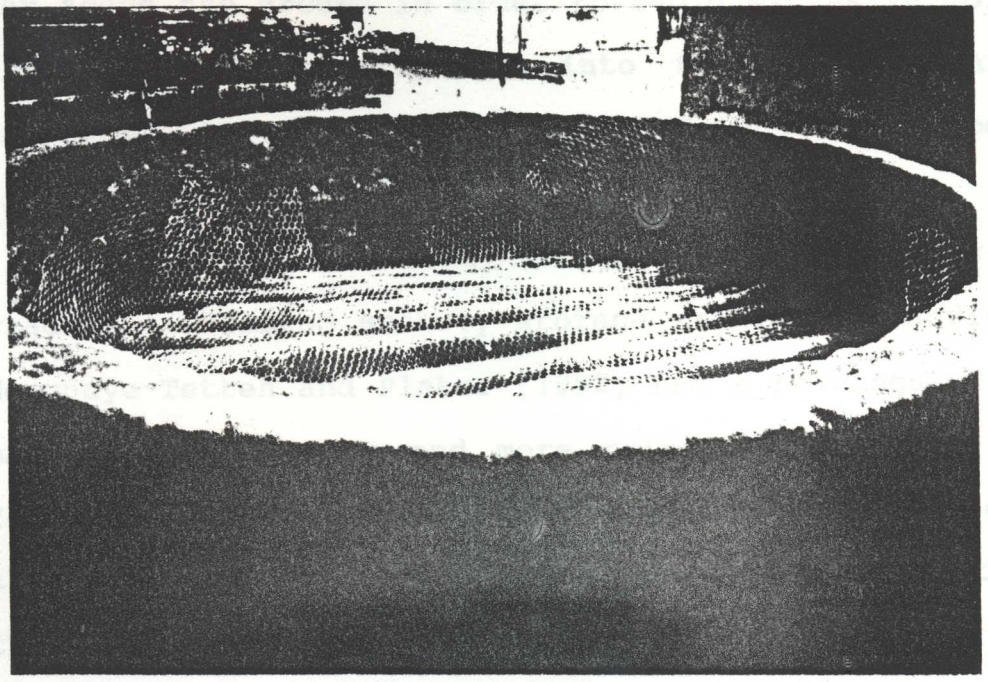


Fig 5. Pictures showing the Round Oven Base Structure



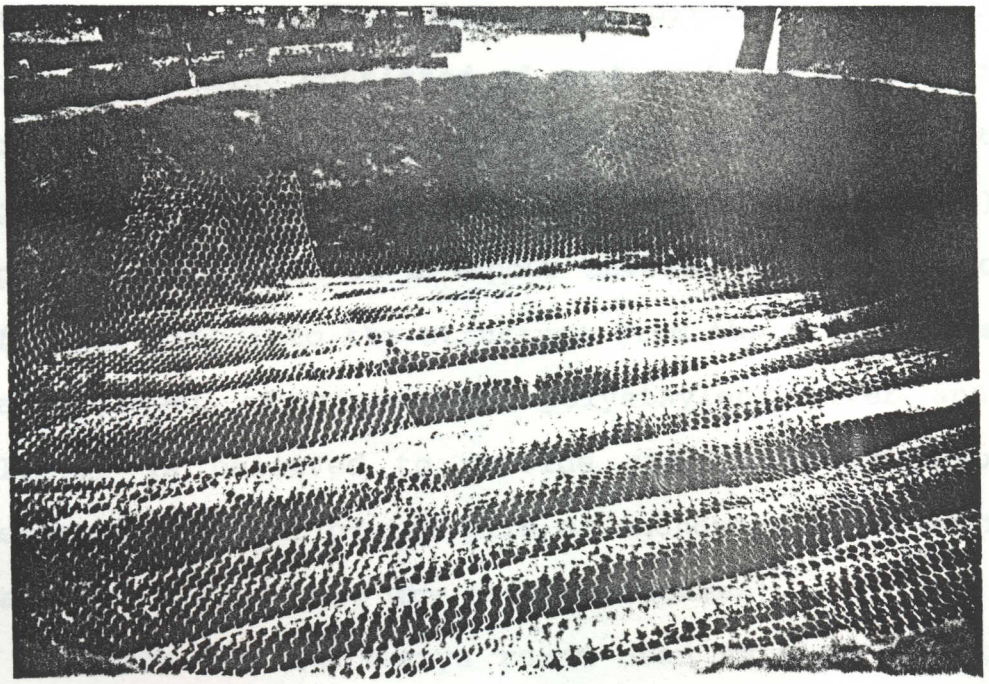


Fig 6. Pictures showing the Oven Base Platform

stored product, this hardcore base support is constructed far above the ground in order to avoid excessive moisture diffusion from the ground into the storage. A damp environment at the base will definitely accelerate spoilage of the smoked fish.

In a previous study at Tema Manhean, a similar traditional smoked anchovy storage structure described by Nerquaye-Tetteh and Plahar (1992) had a rectangular metal base with a thicker and more reinforced hardcore floor foundation. This reinforcement could be due to the fact that the hardcore base was not raised from the ground as is the case with the Akplabanya structure. One other major difference between the two structures is the construction of a straw mat base cushioning on top of the hardcore base support for the Tema Manhean traditional structure. The base cushioning consisted of an 8 cm thick straw mat layer on which was spread a layer of black polyethylene and brown paper lining (Nerquaye-Tetteh and Plahar, 1992). The polyethylene acts as a vapour barrier to prevent moisture from getting into the structure from the ground. The whole arrangement of straw mat, polyethylene layer and paper lining is believed to provide cushioning to absorb the excessive weight of the pile of anchovies to be stored and also to enhance the dry base environment.

With the Akplabanya round oven type of storage, the structure is ready for storage to begin with the lining of the hardcore base platform and the protruding sides of the oven with only brown paper(Fig 7).

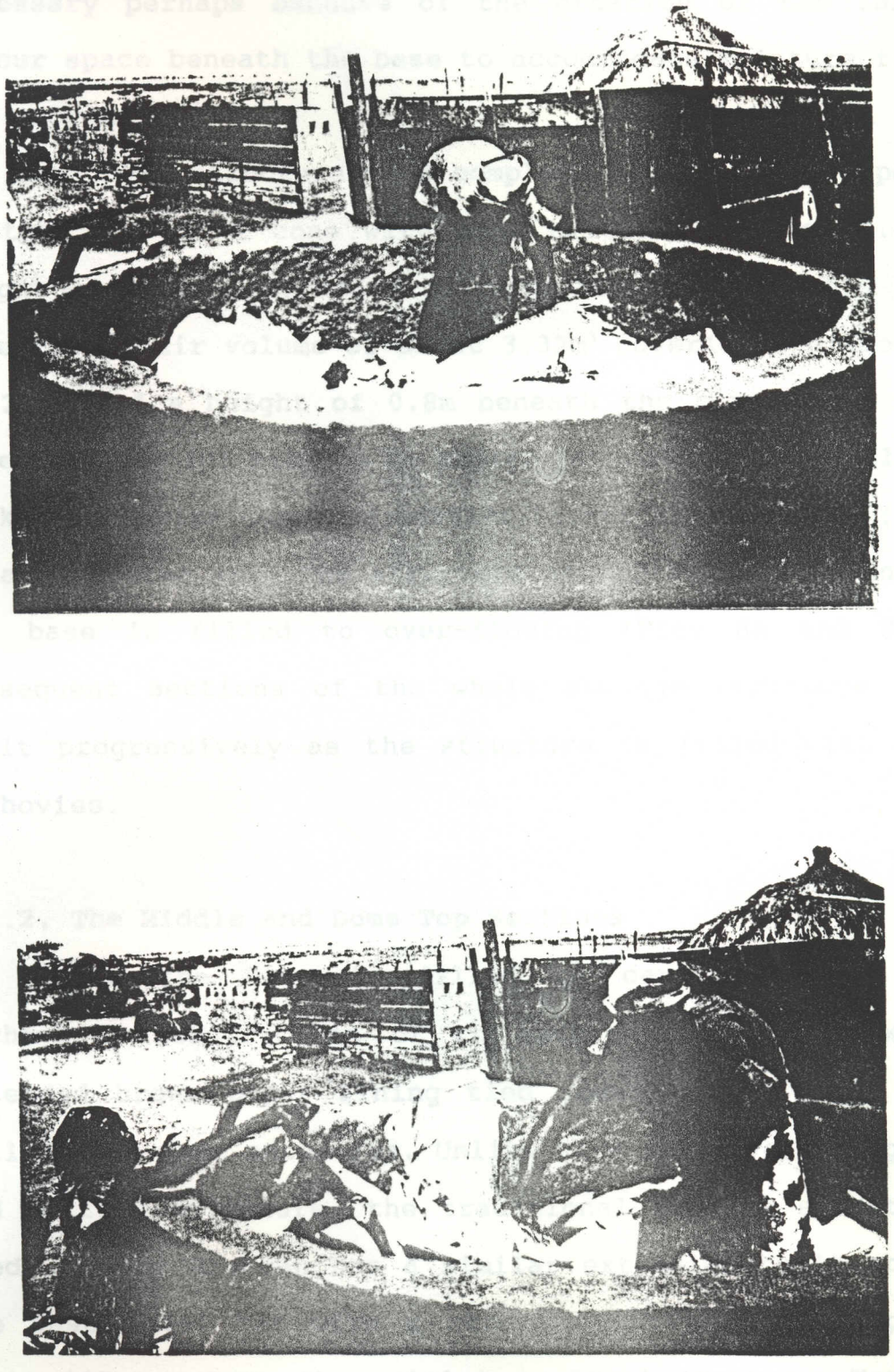


Fig 7. Lining of the base with brown paper

The need for a polyethylene lining has not been considered necessary perhaps because of the creation of the large vapour space beneath the base to accommodate moisture from the ground.

The base structure thus complete has a storage space in the form of a cone with base circumference of 8.0m, height of about 0.4m and a top diameter of 8.3m. This has an enclosed air volume of about 3.32m^3 covering a diameter of 2.3m and a height of 0.8m beneath the platform. The base is ready for storage to begin. Several baskets full of smoked anchovies conveyed earlier to the storage site (Fig 4) are emptied into the structure and spread neatly until the base is filled to over-flowing (Figs 8a and 8b). Subsequent sections of the whole storage structure are built progressively as the structure is filled with the anchovies.

3.1.2. The Middle and Dome Top Sections

After the base is filled to capacity with the anchovies, construction of an extension is built with extended brown paper lining tied round with a rope and filled with more anchovies. Unlike this relatively fragile mid section structure, the traditional storage structure used at Tema Manhean has a similar extension built above the base level but with a strong stick netting support about 105 cm above the metal base level (Nerquaye-Tetteh and Plahar, 1992). The sticks are spaced at about 10 cm intervals and woven together with a long rope.

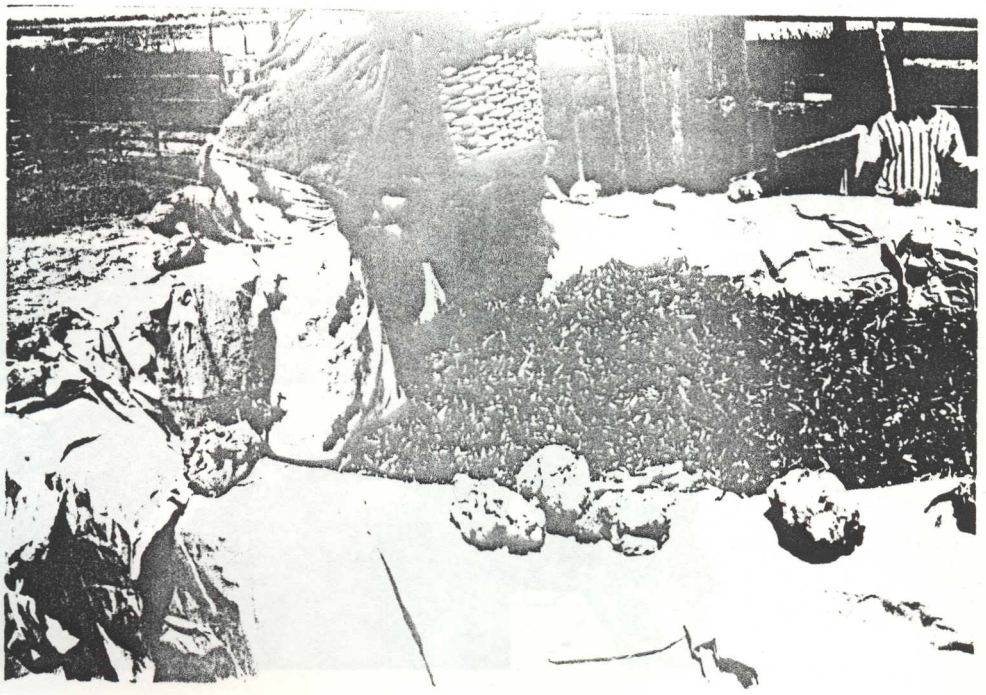


Fig 8a. Filling of the oven base structure with smoked anchovies.

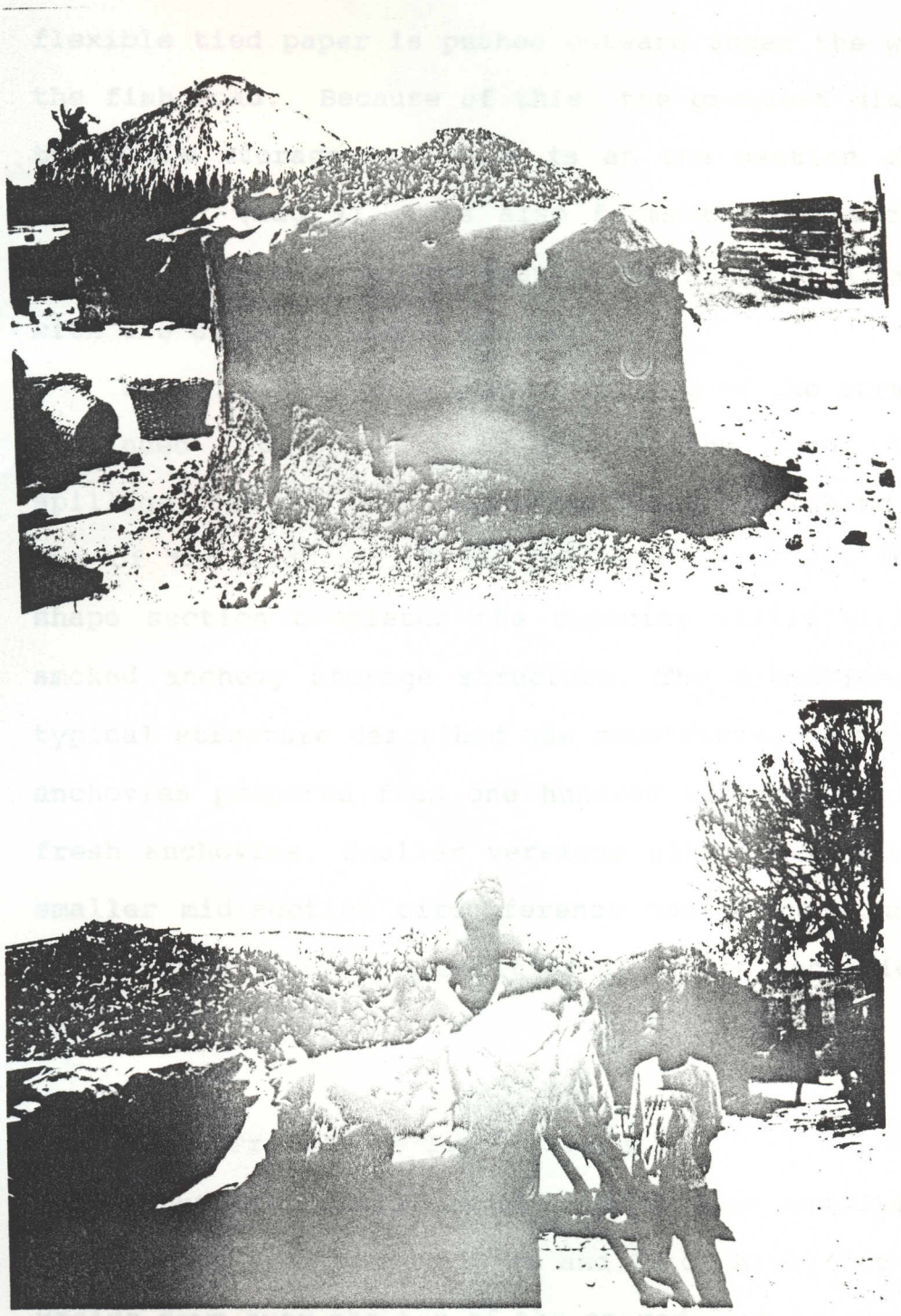


Fig 8b. Filling of the oven base structure with smoked anchovies.

With the Akplabanya round oven structure under study, the diameter of the mid-section widens as the relatively flexible tied paper is pushed outward under the weight of the fish load. Because of this, the greatest diameter of the whole storage structure is at the section above the oven level (Fig 9). This also forms the mid-section. At this point, the structure assumes the shape of a large dome with the strong round oven base.

With the help of a ladder, filling of the structure is continued beyond the height of the oven. To avoid spillage, the top is arranged to form a cone shape with the top of the mid-section as its base (Fig 10). This cone shape section completes the capacity utilization of the smoked anchovy storage structure. The dimensions of the typical structure described was constructed to hold smoked anchovies prepared from one hundred and ninety crates of fresh anchovies. Smaller versions with lower heights and smaller mid-section circumference can be constructed for the storage of fewer quantities of smoked anchovies.

3.1.3. The Protective Top Covering

About five small baskets (with open end diameter of 30 cm, base diameter of 10 cm and 20 cm high) are arranged upside down over the top of the stored fish as shown in Fig 11. The whole structure is covered with a large sheet of thick black polyethylene. The baskets are to prevent the polyethylene cover from a direct contact with the fish.

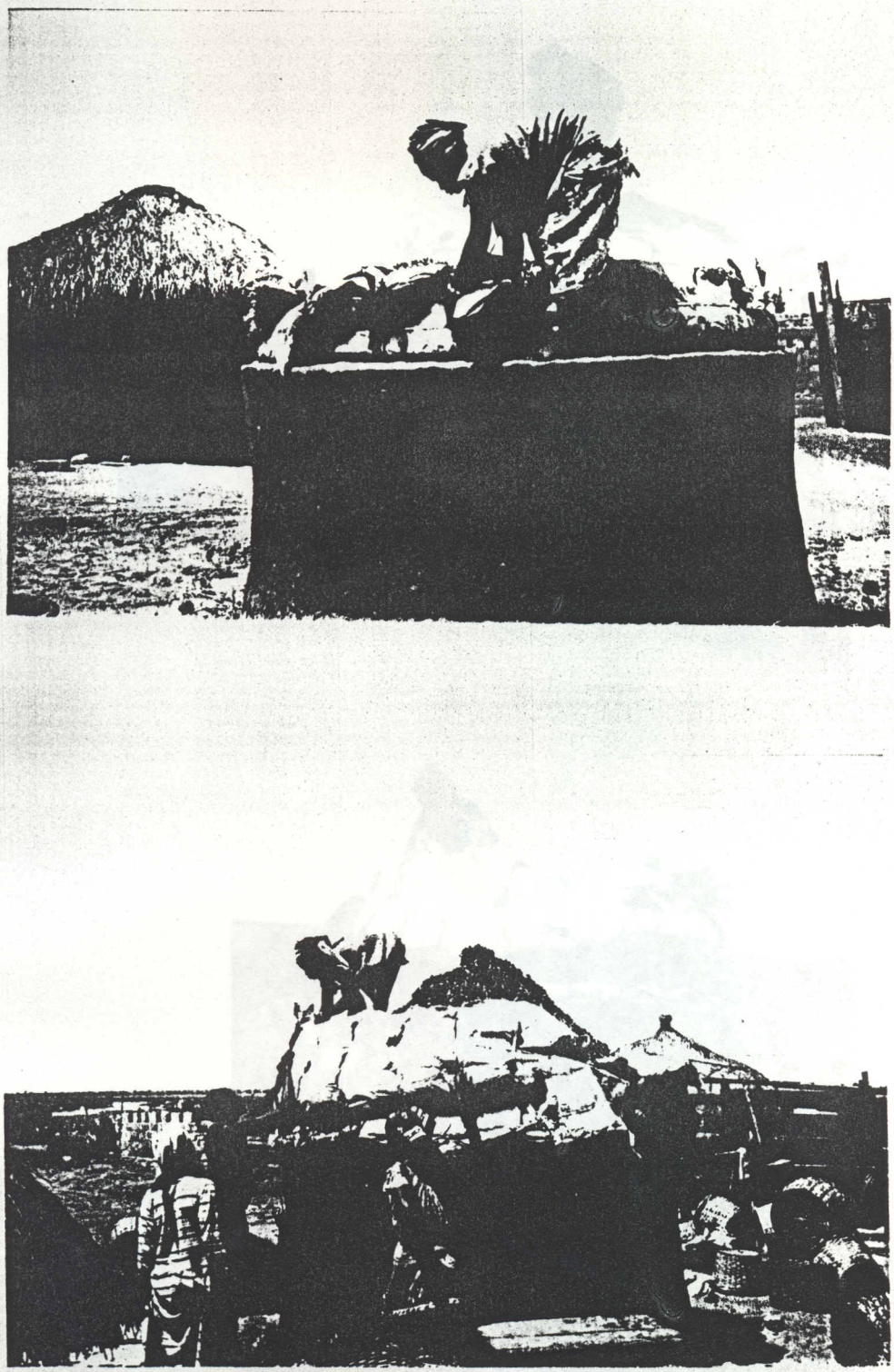


Fig 9. Construction of the Mid-section structure

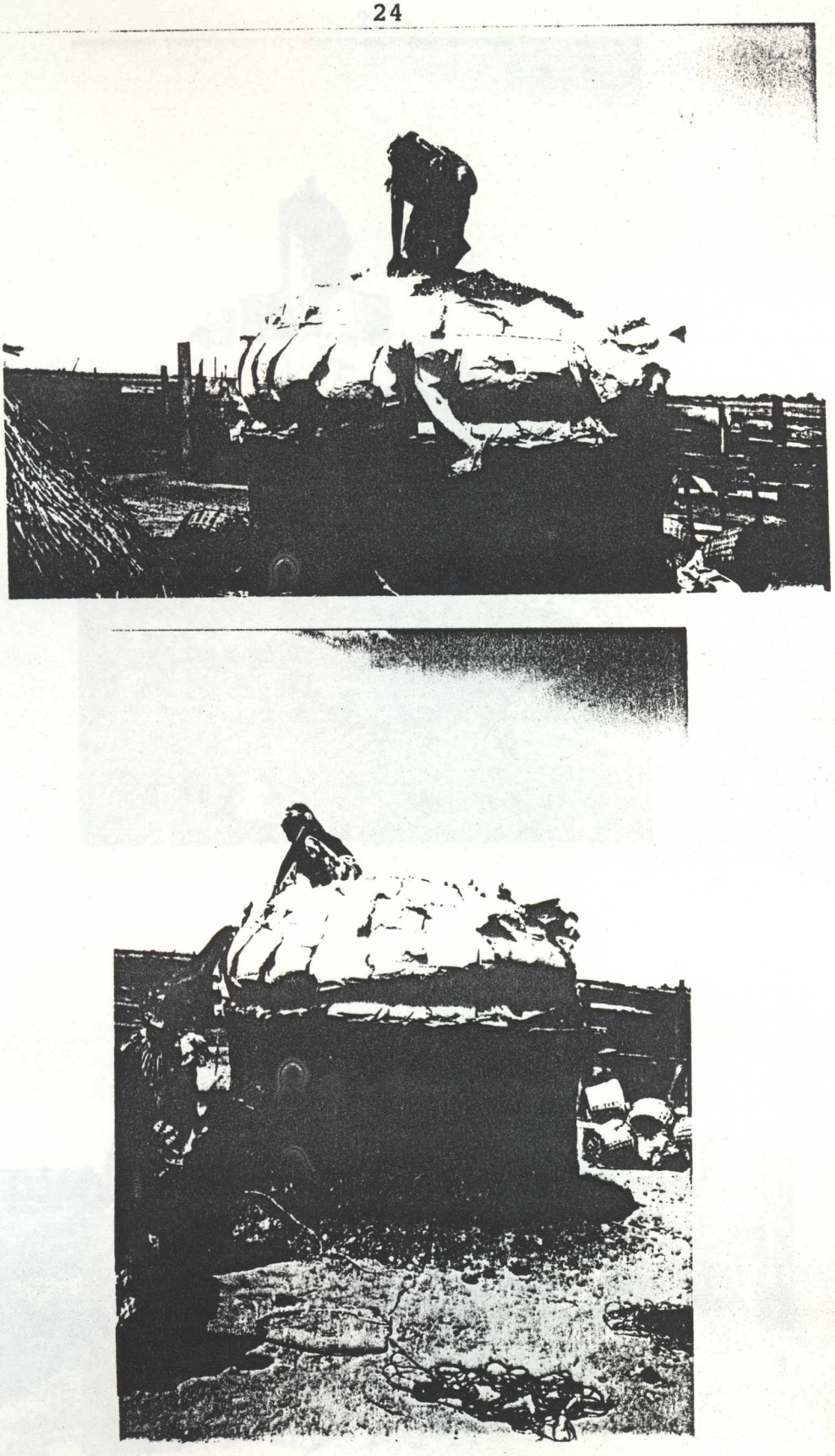


Fig 10. Traditional Round Oven anchovy storage structure filled to capacity

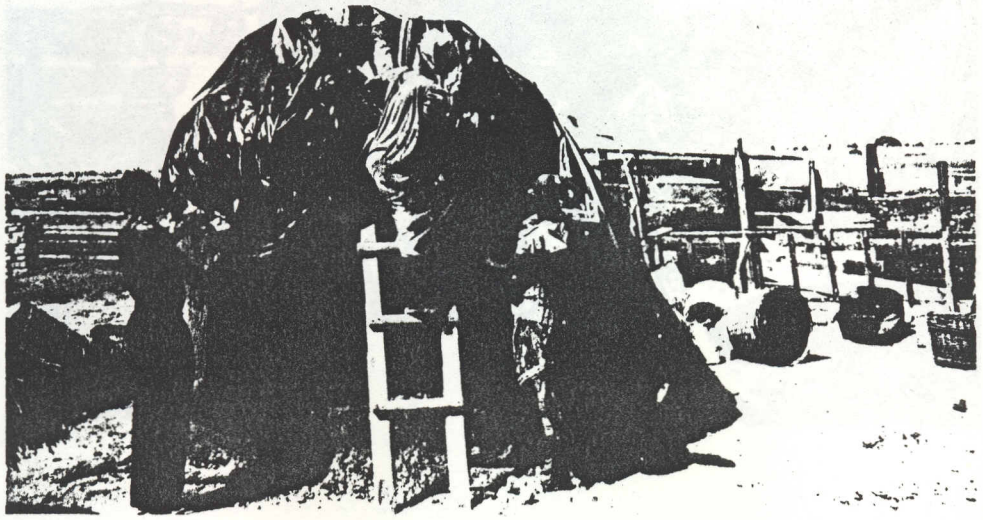


Fig 11. Top protective cover: Basket cover (top picture) and Polyethylene cover (bottom picture).

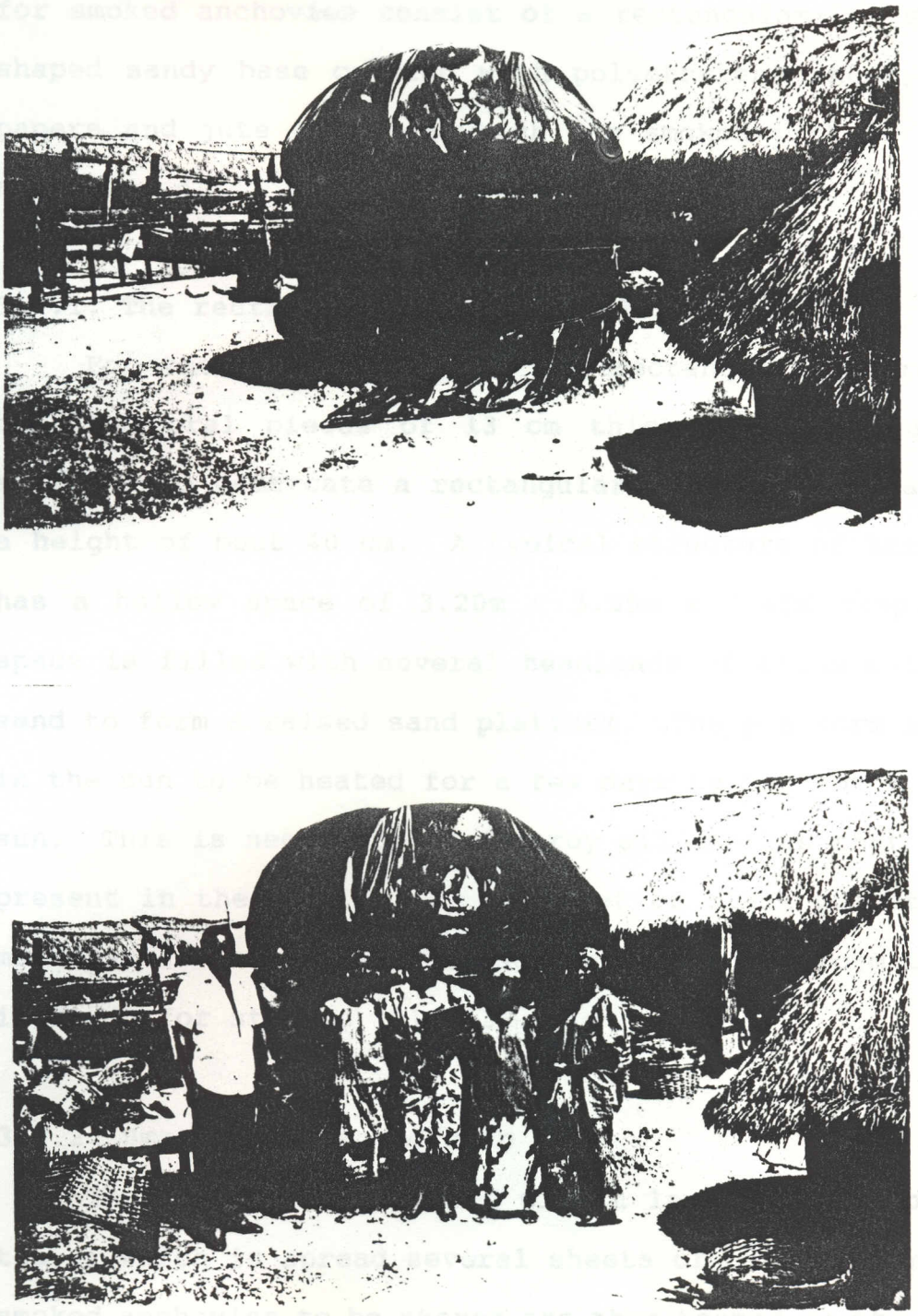


Fig 12. Smoked anchovies in traditional round oven storage.

3.2. THE SEA SAND PLATFORM STORAGE STRUCTURE

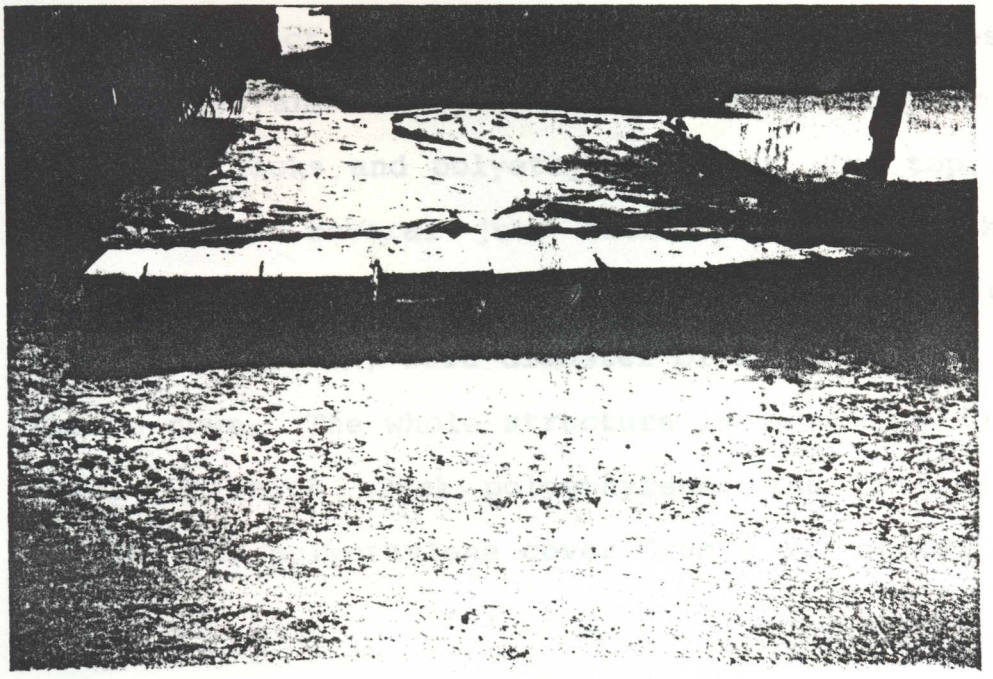
The major features of the sea sand platform storage for smoked anchovies consist of a rectangular- or square-shaped sandy base covered with polyethylene sheet, brown papers and jute sacks on which the smoked fish is heaped and covered.

3.2.1. The rectangular/square sand base

For the construction of the rectangular/square sand base, several pieces of 13 cm thick cement blocks are arranged to demarcate a rectangular or square space up to a height of bout 40 cm. A typical structure of this type has a hollow space of 3.20m x 3.55m x 0.45m deep. The space is filled with several headloads of clean white sea sand to form a raised sand platform. The platform is left in the sun to be heated for a few days by the hot tropical sun. This is necessary to destroy all insects that may be present in the sand. A large sheet of black polyethylene material is then spread on the sandy base platform to make it ready for storage (Fig 13).

3.2.2. Smoked fish mound/heap

The platform is covered with a layer of jute bags on top of which is spread several sheets of brown paper. The smoked anchovies to be stored are then heaped on the raised platform to form a large dome. Here again, the height or size would depend on the amount of fish available for storage.



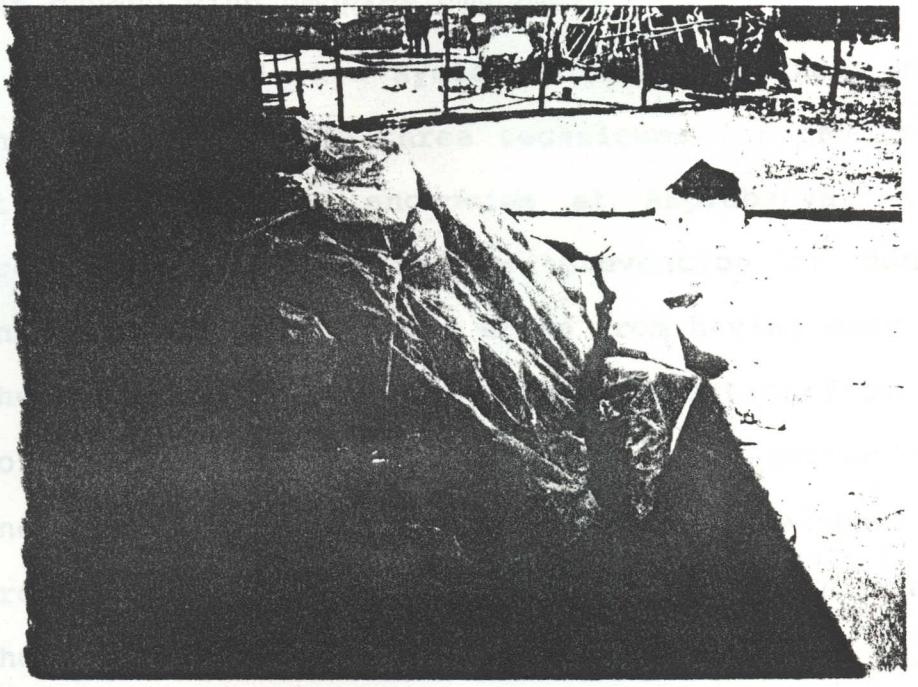


Fig 13. The sea-sand platform storage structure

3.2.3. Protective top covering

To protect the fish excessive storage losses due to the weather and insect pests, the whole heap is covered with jute sacks and polyethylene sheet. The top is first covered with several jute sacks, on top of which are arranged about five medium size baskets (with open end diameter of 30 cm, base diameter of 10 cm and 20 cm high) upside down. The whole structure is covered with a large sheet of thick black polyethylene. The baskets are to prevent the polyethylene cover from a direct contact with the fish.

3.3. THE FENCED YARD STORAGE STRUCTURE

The fenced yard system of smoked anchovy storage is the simplest of the three techniques for the traditional storage of smoked anchovies at Akplabanya. The main protection effected is the prevention of domesticated animals such as goats and sheep from having easy access to the stored fish; in addition to protection from rain with polyethylene cover. Apparently, this method of smoked anchovy storage is only a temporary one used when the product would have to be disposed of within a relatively short period of time.

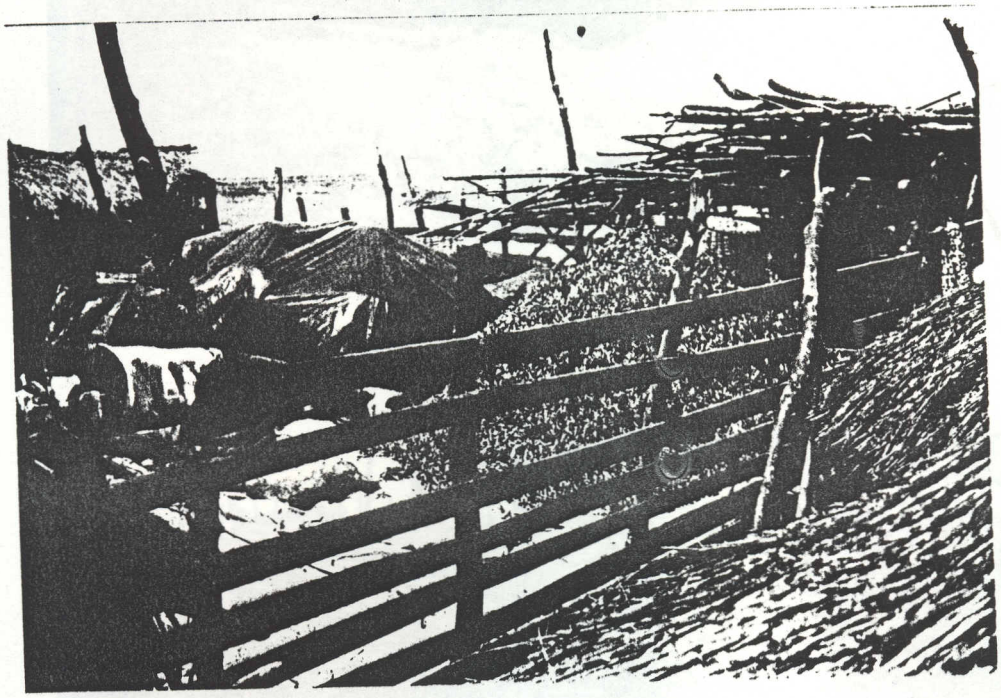


Fig 14. Picture showing a traditional fenced yard storage structure constructed with timber board pieces.

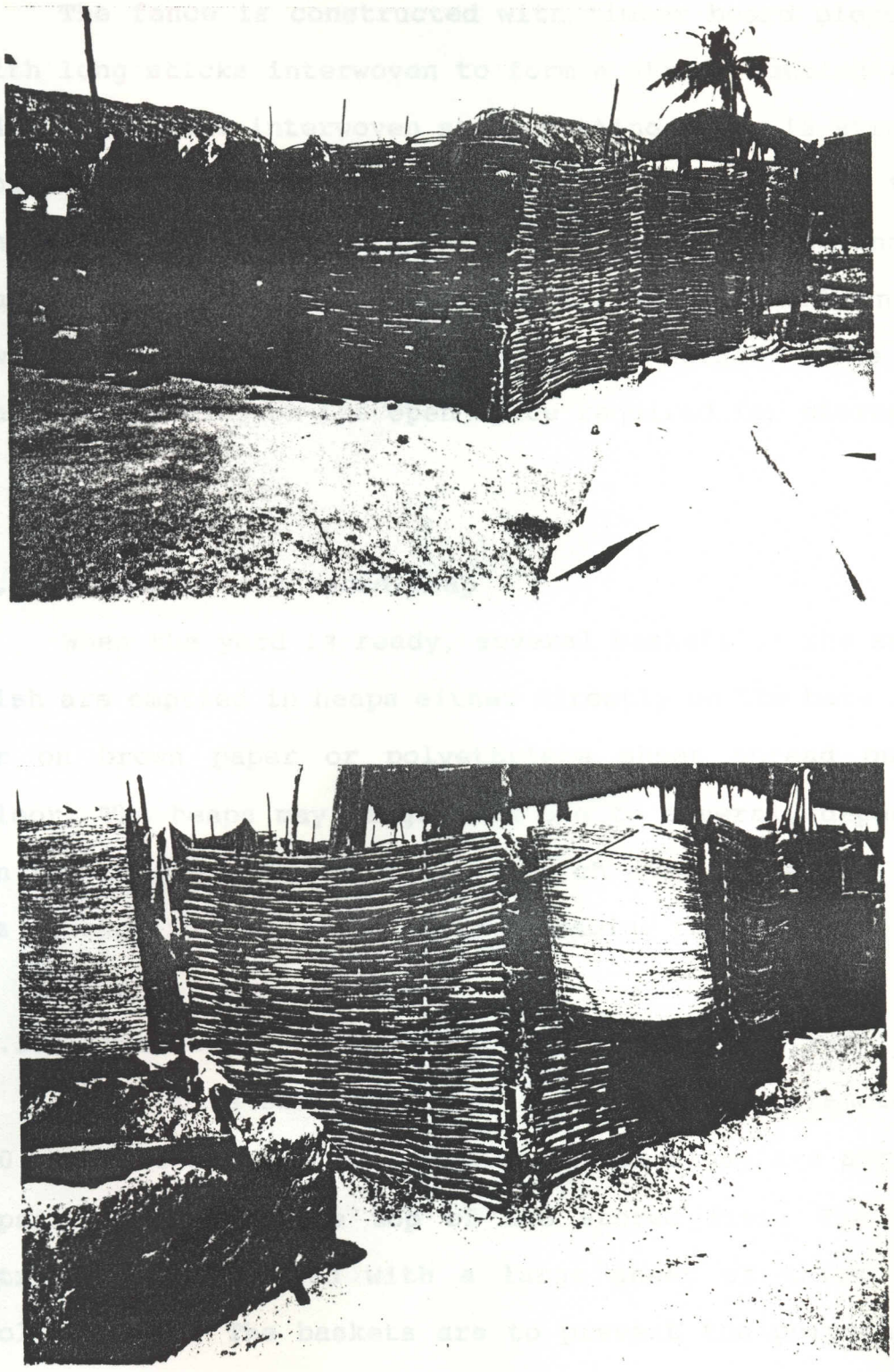


Fig 15. Pictures showing a fenced yard traditional storage structure constructed with woven sticks.

3.3.1. The fenced yard

The fence is constructed with timber board pieces or with long sticks interwoven to form a strong netting (Figs 14 and 15). The interwoven stick netting fence is stronger and offers better protection than the timber board fence which has too many wide openings. For easy monitoring and surveillance, the fenced yards are constructed on the dwelling compounds or just behind the houses. The size varies depending on the open space required for storage.

3.3.2. Smoked fish mound/heap

When the yard is ready, several baskets of the smoked fish are emptied in heaps either directly on the bare floor or on brown paper or polyethylene sheet spread on the floor. The heaps may range from one to several, depending on the size of the fenced yard which also serves at times as storage for baskets used in packaging the fish for sale.

3.3.3. Protective top covering

About five small baskets (with open end diameter of 30 cm, base diameter of 10 cm and 20 cm high) are arranged upside down over the top of the stored fish. The whole structure is covered with a large sheet of thick black polyethylene. The baskets are to prevent the polyethylene cover from a direct contact with the fish.

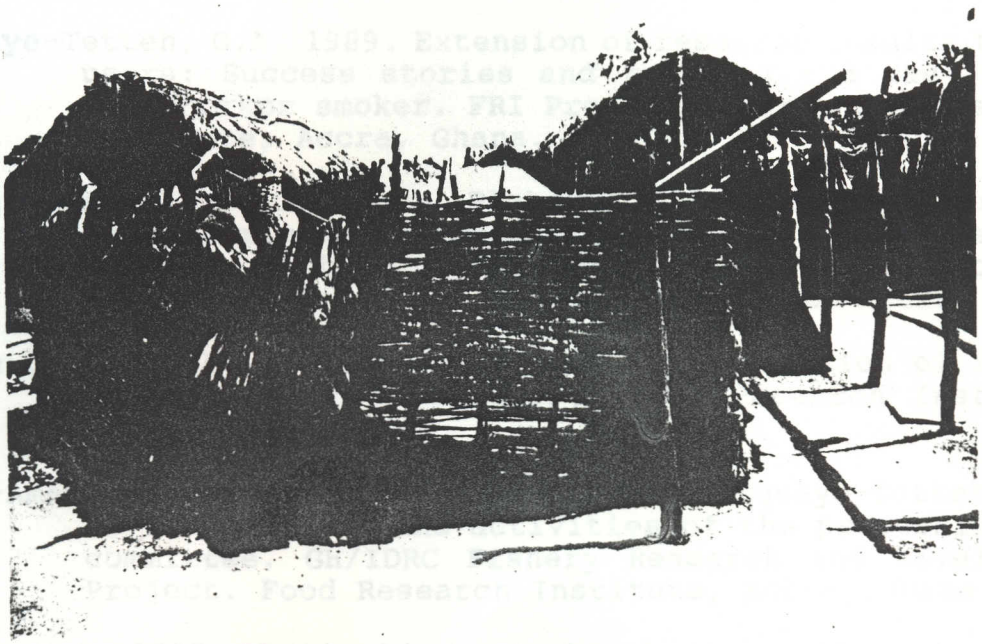


Fig 16. Pictures showing fenced yard storage with baskets ready for packaging.

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APPENDIX I

ARTISANAL FISH PRODUCTION (CANOE FISHERIES) IN GHANA

(1984 - 1989)

SPECIES	Annual Production (Metric Tonnes)					
	1984	1985	1986	1987	1988	1989
Round Sardines (Sardinella aurita)	34,816.3	54,072.5	45,488.6	45,670.7	75,851.5	61,158.5
Flat Sardines (Sardinella eba)	10,077.1	22,233.9	16,633.5	25,479.2	10,450.4	14,097.7
Club Mackerel (Scomber japonicus)	540.3	44.2	16,865.7	397.3	7,423.5	11,036.8
Anchovy (Anchoa guineensis)	47,230.9	27,590.3	15,208.5	87,984.4	75,902.3	76,347.9
Firigate Mackerel (Auxis thazard)	7,079.1	3,521.0	3,255.7	4,689.3	6,382.5	4,129.2
Seabreams (Lethrinus atlanticus)	9,060.1	6,258.1	7,069.9	9,737.5	13,039.9	10,431.9
Burrito (Brachydenterus auritus)	15,998.6	12,369.0	19,234.1	13,516.4	8,434.2	7,611.8
Others	46,431.3	33,809.4	66,440.2	74,909.5	46,557.9	36,064.9
Total	171,233.7	159,899.4	190,196.5	262,384.3	244,557.9	220,877.7

Source: Fisheries Dept. (Research and Utilization), Ministry of Agriculture, Accra.