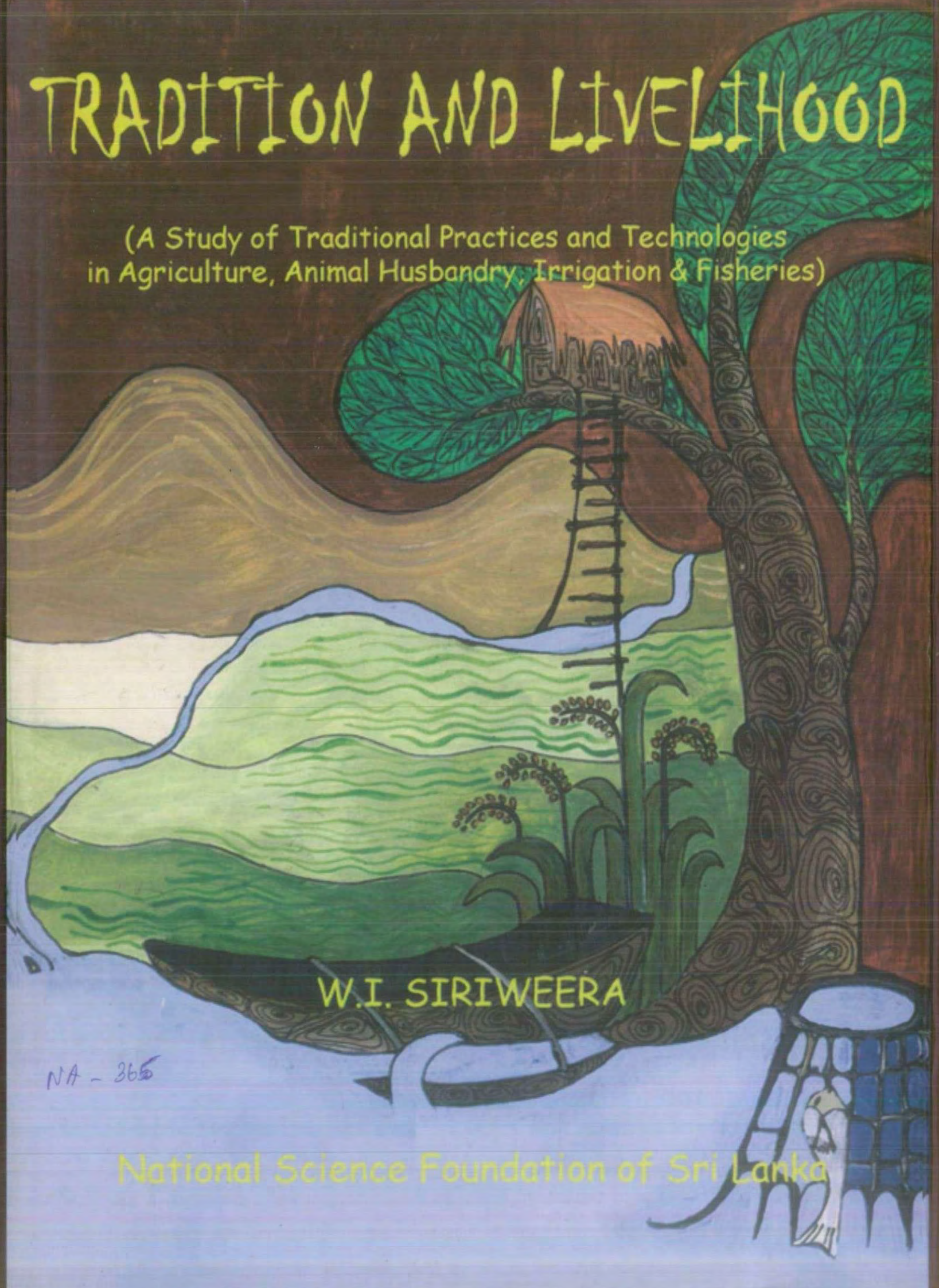
TRADITION AND LIVELIHOOD

(A Study of Traditional Practices and Technologies
in Agriculture, Animal Husbandry, Irrigation & Fisheries)



W.I. SIRIWEERA

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Tradition and Livelihood

(A Study of Traditional Practices and Technologies in Agriculture, Animal Husbandry, Irrigation and Fisheries)

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Foreword

Traditional practices and technologies in agriculture, animal husbandry, irrigation and fisheries in Sri Lanka have been environmentally friendly and in total harmony with ecological cycle. The resource use system has been sustainable and has provided a high degree of stability to the local economies. Paddy cultivation and animal husbandry techniques have not only maintained ecological balance but also have contributed to solidarity among village communities. The construction and maintenance of irrigation works as well as the rituals associated with reservoirs have been part of participatory water management. They symbolize a strong bond among villagers and illustrate the collective responsibility. Techniques and practices in both marine and inland fisheries have also contributed to unity and bond among fishing communities and close relations with village institutions.

With the population increase, the decrease of man – land ratio and the introduction of modern machinery mostly imported from abroad, the traditional practices and technologies associated with the above have been fast diminishing and going through a change. They also have resulted in drastic social transformations. Therefore, documenting traditional practices and technologies becomes absolutely necessary before some of them completely recede into oblivion.

Having recognized the valuable contribution he has made in History, Agriculture, Animal Husbandry, Irrigation and Fisheries, for which he had been awarded the honorary degrees of D.Lit and D.Sc. by two Sri Lankan Universities, the Board of Management of the National Science Foundation identified Emeritus Professor W.I. Siriweera as the most suitable person to undertake this task of documenting the traditional practices and technologies related to these areas.

I believe that this publication fills an information void and will be of immense use to scientists, researchers, sociologists, historians, policy planners as well as the general public.

Dr. M. C. N. Jayasuriya
Director
National Science Foundation of Sri Lanka
March 2009.

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I am deeply grateful to all of them.

W. I. Siriweera
Ethulkotte
Sri Jayawardenapura
February 2009

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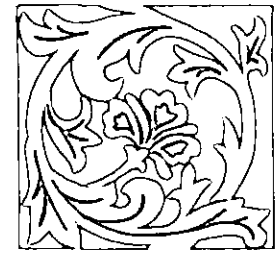

CHAPTER I

AGRICULTURE

Chena Cultivation

The earliest form of farming system throughout the world was *chena* or swidden cultivation, otherwise known as slash and burn cultivation. It was a system in which the main characteristics were the rotation of plots rather than of crops, clearance by fire, and short periods of soil occupancy alternating with long fallow periods in order to ensure continuing soil fertility. The *chena* farmer chose a patch of forest, secondary or primary, cut down some of the trees with an axe or billhook, leaving only the larger trees which were economically useful. The undergrowth was then cleared with a knife or cutlass and the debris burnt. Generally, the only fertilizer the crops received was the ash from the initial burning, which provided potash. Burning also heated the surface soil and sterilized it against organisms responsible for diseases.

Seeds were sown on the clearing – swidden – with minimum of preparation. In some cases dibbling sticks and hoes were used for the preparation of the land. The crops received only cursory attention during growth and not much was done to control the exuberant weed growth. Harvesting methods varied; but mostly cereal heads were picked by hand, while root crops were dug with sticks, hoes and mammoties.

The swidden or *chena* cultivator did not change his dwelling when he turned to new land, but remained settled in a fixed abode. However, a watch-hut was built in the swidden plot mostly at a height, between large branches of a tall tree. and the farmer lived in it especially at the time when the ripening crop had to be protected against animals. He also constructed wooden fences around *chenas* to protect the crops from wild animals.

This farming system was easy in a situation of low population density, because longer fallow periods were required to maintain soil fertility. In economic terms, it resulted in a reasonable return for minimal labour expenditure.

In Sri Lanka too, the earliest form of cultivation was *chena*. *Chena* cultivation was dependent on rain water and did not require a regular supply of water. Thus the adoption of rice did not require any great advance in technology either and dry paddy could be grown in rotating plots. Medieval Sinhala literature refer to rice (*Oryza sativa*) grown under slash and burn techniques as *alvi* or *goda goyam* [1].

Only when demographic growth necessitated an improvement in the methods of cultivation, irrigated rice techniques became important. The overall balance however, between *chena* and irrigated rice agriculture varied, depending on the rainfall and the availability of water and man-power.

Apart from paddy, three crops grown in *chena* plots namely cotton (*Gossypium harbacenumi*), sugar cane (*Saccharum officinarum*) and sesame (*Sesamum indicum*) were important throughout the historical period and three principal cottage industries developed around them. In classical literature, there are frequent references to *kapu hen*, *uk hen* and *thala hen* which means *chena* land where cotton, sugar cane and sesame were grown. Only luxury cloth was imported to the island particularly from Eastern India and China even during the heyday of the period of the Rajarata civilization for the use of royalty and the nobility. The island's requirements of cloth had therefore to be met from local sources. Thus cotton (*kapu*) had to be grown extensively to cater to the weaving industry. Sugar requirements of the people were met by the cultivation of sugar cane (*uk*). References to machines which were used for the extraction of juice from sugar cane (*uk yanthra*) and jaggery made of the juice (*uk sakuru*) are frequently found in classical literature. As in Mesopotamia, edible oil was obtained mostly from sesame in the ancient Dry Zone and this explains the frequent references to *tala hen* (*chena* where *tala* was grown) in the texts.

Kurakkan or finger millet (*Elusine coracana*) was a key substitute for rice in the Dry Zone throughout the historical period. Hence, *chena* cultivators grew finger millet as a main cereal crop along with other cereals such as *undu* (*Phaseolus mungo*), *ma* (*Vigna cylindraica*), *mun* (*Phaseolus aureus*), *meneri* (*Paspalam scrobiculatum*), *aba* (*Brassica juncea*), *duru* (*Cuminum cuminum*) and *tana* (*Setaria italica*). In these swidden cultivations intertillage or mixed cropping was common. The main vegetables grown in swiddens were *karabatu* (*Solanum spp.*), *tibbatu* (*Solanum indicum*), *vambatu* (*Solanum melongena*), *alu puhul* (*Benincasa hispida*) and *wattakka* (*Cucurbita maxima*).

Even after the abandonment of the Dry Zone civilization in the middle of the thirteenth century, *chena* cultivation continued throughout the centuries and it was the main sustenance of the peasants in isolated pockets of settlement. Leonard Wolf's portrayal of: A Village in the Jungle [2] clearly depicts the subsistence system in the Dry Zone from the thirteenth century onwards until the Dry Zone colonization programmes began in the 1930's. Even in the intermediate zone *chena* cultivation was practised to a considerable extent.

Historically, until about the beginning of the twentieth century, *chena* lands, belonged to collective village communities. It was by amicable arrangement that the villagers decided on the seasonal allocation of land that was to be granted to each person. Later, it was when the British government claimed all unoccupied forest land, that forest laws were introduced.

The Forest Ordinance prohibited the clearing of Crown land for *chena* cultivation without permit. *Chena* permits were not given for cultivation of land within 100 yards of a high road; 50 feet of a stream or any area of forest containing full grown trees. The clearing of land liable to erosion or land required as protective catchments was also prohibited by a Land Order in 1940. This also precluded

the cultivation of land with a slope of over 30 degrees and the cultivation of the tops or whole of forest clad hills [3]. However, such rules and regulations have not been effective, due to the shortage of food during the Second World War and the emergency food production drive during that era.

Even after independence, until 1981 the government allowed the use of forest land for purposes of *chena* cultivation through a system of issuing permits. The issue of permits was officially terminated in that year. However, *chena* cultivation continues in the Dry Zone and to a lesser extent in the intermediate zone even at present. The number of families which depend mainly on *chena* in the Dry Zone is relatively high. During seasons of rain failure or poorly distributed rain, the main form of subsistence farming in the Dry Zone is the *chena* cultivation. Outside the Dry Zone, *chena* cultivation also extends to the low foothills of the central massif in the Matale and Nuwara Eliya Districts, generally below an altitude of 2000 feet. The private ownership of *chena* land is limited to about 0.06 per cent of the total area of forest in all zones.

Currently there are several types of *chenas*. They are *Mukalan hena* (මුකලන් හේන), *At danduva hena* (අත්දඬුවා හේන), *Landu hena* (ලදු හේන), *Kanatta hena* (කනත්ත හේන) and *Pitiya hena* (පිටිය හේන). The *Mukalan hena* is a land cleared out of a large forest. *At danduva hena* is a land cleared of small trees of the size of human limbs. The *Landu hena* is land cleared of shrubs. The *Kanatta hena* is land cleared of creepers, in land with fewer trees. The *Pitiya hena* is a *chena* land cultivated several times previously [4].

Some key characteristics of *chena* lands illustrate the traditional practices of the peasant. The selection of locations for *chena* was done through group consensus and it was confined to the area of authority of the village. The farming schedule was prepared after discussion with all prospective *chena* cultivators in the area so that group action could be ensured throughout the period of cultivation. The overall protection of the plots was also ensured through group action as watching was done in turns.

Chena cultivation usually commences in the months of June and July, but there are regional variations depending on the weather patterns of a particular year. Initially shrubs and small trees are cleared. Burning is carried out to ensure that the fire spreads in the direction of the wind. Large stems and branches, un-burnt or partially burnt are piled along the edge of the *chena* to strengthen the enclosure. The permanent fence (*dandu vata*) is constructed after the plants have grown. The harvesting in most instances is completed by October.

The main *chena* crops that have survived up to now are Indian corn or maize called *karal iringu* or *bada iringu* (*Sorghum vulgare*), *kurakkan* (*Sesamum indicum*) along with other subsidiary grains such as *amu* (*Paspalum scrobicalutum*), *tana* (*setaria italica*), *meneri* (*Panicum miliaceum*), *mung* (*Phaseolus aureus*), *ma* (*Vigna cylindraica*), *kollu* (*Dolichos biflorus*) and *undu* (*Phaseolus mungo*) and vegetables and yams.

Karal iringu or *Bada iringu* is not an indigenous grain and it is not mentioned in ancient Sinhala or Pali literature. It is not a grain introduced recently. Most likely it was introduced into the island during the European encounters in the sixteenth or seventeenth century.

Some farmers plant seeds of *Vattakka* (*Cucurbita maxims*), *Kakiri* (*Cucumis trigonus*), *Komadu* (*Citrulus vulgaris*), *Labu* (*Laganaria vulgaris*), *Puhul* (*Benincasa hispida*), *Watakolu* (*Luffa acytangula*), *Karivila* (*Momordica harantia*), *Dambala* (*Phaseolus lunutus*), *Avara* (*Capcium annum*), *Bandakka* (*Hibiscus esculentus*), along with or just after the Indian Corn is planted. Once these plants are about one to two feet high, grains such as *kurakkan*, *mung*, *meneri*, *amu*, *kollu*, *aba* and *tala* are sown.

Paddy cultivation in dry *chena* land is fast diminishing, but the practice still continues in a few areas, both in the wet zone and the dry zone. These dry paddy lands are called *äl ket* and *kekulam ket* in general. At Ampara they are called *Mummâri* and in Vellassa *Malan kumburu*. Until 1970's dry sowing of paddy existed in the Jaffna peninsula as well and it was called *pluthi* in Tamil. But there, it is now virtually non existent.

In this *chena* or dry form of paddy cultivation, the initial process is the clearing and burning of grass. In certain areas the dry land is ploughed, but more often it is dug with a mammoty and then levelled. The varieties sown in these dry lands are called *Batudäl* (බටු දැල්), *Kossäta* (කොස්සාට), *Raddäl* (රද්දැල්), *Adigam äl* (අඩිගම් අල්), *Ambula äl* (අඹුල අල්), *Kalu al* (කළු අල්), *Kitul al* (කිතුල් අල්), *Gônabaru* (ගොනබරු), and *Suvandal* (සුවඳැල්) [5].

The seed paddy is germinated before sowing, as it is done in muddy fields. The dry varieties of paddy grow in bushes and therefore about two seeds are sown for a space of about nine inches. After sowing, the seeds are covered with soil. This is done by dragging a thorny bush over the seeds. In some other cases, seeds are covered with soil with a mammoty or a levelling board fitted with iron nails. After the rains, the seeds germinate and sprouts begin to appear. Dry paddy cultivation is limited only to the *Maha* season and the varieties sown take about three to four months to mature.

Cotton cultivation in *chenas* has virtually disappeared during the last half century and large extents of sugar cane are now found no more in *chena* plots. Sugar cane cultivation has in fact taken a new direction in the recent past with the government or private sector participation.

Presently, the most important grain crop in the *chenas*, in addition to maize, is *kurakkan*. With the onset of monsoons in October, seeds are sown or broadcast and then covered. Not more than two crops are sown during one season. After the harvest, the *kurakkan* pod is dried in the sun and kept under cover to be used when required.

Traditionally, the grain is made into flour by grinding it in a specially designed domestic grinder known as the *Kurahan Gala* or *Kurakkan Gala*, which has been chiseled out of granite. The grinder consists of two pieces and the grain is crushed between the two flat surfaces of these pieces.

The lower stone, which is the stationary component, is a cylinder about 6 inches in height. It has, in the centre of its upper surface a short wooden stick, planted firmly in an upright position. This pole fits into a central cavity in the upper stone, which is the rotary component. The cavity is in the shape of an inverted cone. The upper stone is also a

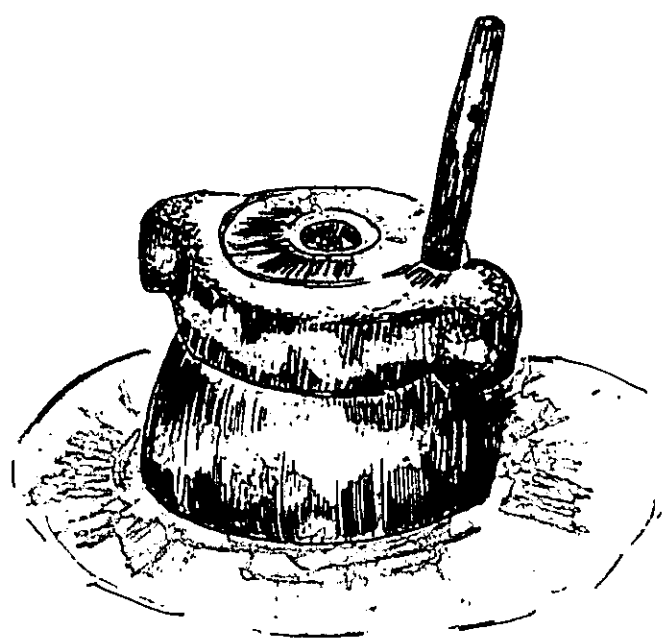

Figure 1: Kurahan gala

cylinder of the same size as the lower stone, but it has two winged projections situated diametrically opposite each other. The handle for turning the stone is again a short stick planted upright to one of these projections. *Kurakkan* grain is poured into the central depression formed by the inverted cone, which acts as a small reservoir. When the upper stone is rotated rapidly, the grain percolates through the apical hole on to the upper surface of the lower stone, where it is crushed between the two surfaces. The rapid rotatory movement propels the crushed grain towards the periphery of the lower stone, from where it is ejected out as flour. As this occurs, more *kurakkan* grain is fed in from the central reservoir [6].

The two most popular foods prepared with *kurakkan* flour, are the *kurakkan roti* and *kurahan talapa*. The *roti* is prepared by making the flour into a paste mixed with coconut, salt and water. The paste is then beaten out flat on a chatty, put over the fire and baked. The *talapa* or the porridge is made by a more complicated procedure. Boiling water is added to the flour, mixed with a hand pestle and the mixture reduced to a paste. The *talapa* is not bitten or chewed but gulped, together with a varity of gravies. Other foods prepared with *kurahan* flour are *kurahan pittu* and *kurahan halapa*. *Kurahan* is believed to have some medicinal properties; e.g. It helps in the reduction of excessive blood sugar. It also has a high content of dietary fibre.

Upto the middle of the twentieth century, *kurahan* or *kurakkan* had intermixed in *chena* with cotton. But from about the middle of the twentieth century cotton cultivation had completely disappeared. When the practice was in existence, the ratio sown was about four measures of cotton to one measure of *kurakkan*. The latter grew faster and was harvested before the cotton approached maturity. The cotton tree grew to about a height of six feet and began to flower six months after sowing. The pods burst in about eight months and were harvested in the following three months. Plants were pruned at the close of the season. Fresh shoots appeared soon after. The second crop was obtained in the middle of the second year, after which the *chena* was abandoned.

The cultivation of cotton, had produced the local requirement of cotton for cloth weaving for centuries, but by the beginning of the nineteenth century this cultivation had diminished in importance. The average yield had been 2 cwt. seed cotton per acre in *chenas*. Nevertheless, the British government had made efforts to encourage cotton cultivation in the Dry Zone from about 1833 A.D. onwards. Later this interest died out, but in 1880's, after the crash of the coffee industry, some enthusiasm was regained. Experiments were conducted at Maha Illuppallama, Anuradhapura, Kurundalkulama, Jaffna, Hambantota, Ambilipitiya, Vavuniya, Dambulla and Bibile. Unfortunately, these efforts were a failure [8].

Sesame called *tala* in Sinhala and *ellu* in Tamil is a crop grown mostly in the red clay soils of the Dry Zone in *chena* lands. The land is usually cleared in January and February and seeds are sown in February and March. Some farmers sow *meneri* and *mung* also along with sesame. After being sown, seeds are covered lightly with soil with the use of a mammoty. The sesame plant grows in the shape of a bush to a height of about four to five feet. The plant requires rain at the time of sowing and for about two weeks after sprouting. It also requires rain when about to flower. However, too much rain during other periods could damage the plant. The crop needs three months to ripen and is harvested in May. The land could be used for *kurakkan* and other grains after harvesting.

The sesame seeds are found in a pod of about one and half inches long and each pod contains about 30 to 40 seeds. When dried the grain is used for the preparation of various food items.

Oil making from the sesame grain still prevails as a cottage industry in certain areas of the Dry Zone. In places such as Sekkupitiya off Kekirava *sekku* or contrivances drawn by bulls are used for the purpose but in most cases a wooden press is used for extracting oil.

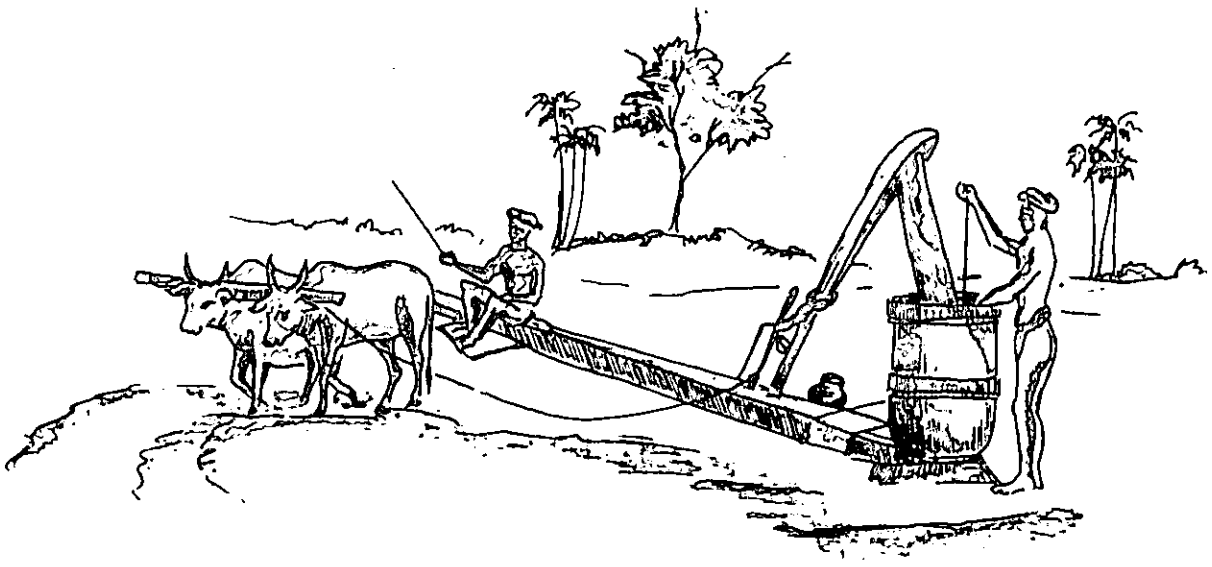

Figure 2: Traditional Oil mill

The seeds are first steeped in cold water, then pounded in a *Vangediya* or mortar with a pestle. The pounded grain is again placed in water in order to separate the husks. Once the husks rise to the surface of water, they are separated and the seeds are dried in the sun. When completely dry, the seeds are soaked in boiled water again and placed in a wooden press. The oil that pours through the wooden press is then collected into special vessels.

Sesame oil is used by Tamils for applying on the body before bathing. All communities use the oil for medicinal as well as for culinary purposes.

Wet-rice Cultivation

Seed agriculture in China and North-Eastern India dates from at least the fourth millennium B.C. when rice was first domesticated. Subsequently, wet rice techniques spread along the Indus Valley into the whole Indian Peninsula and later on to Sri Lanka, most probably in the beginning of the first millennium B.C.

In Sri Lanka, systematic wet-rice cultivation which began around the Malvatu, Daduru and Mahaveli rivers soon spread to other parts of the island. In fact, in the ancient Dry Zone civilization, wet-rice cultivation was the pivot around which the economic life of the villager revolved. It was also the main source of revenue for the king.

Traditional wet-rice cultivation techniques have changed very little throughout the centuries. For instance, the practices mentioned in the classical text *Pujavali* in the thirteenth century or Robert Knox's *An Historical Relation of Ceylon*, published for the first time in 1681, are not very different from those practices which prevailed in the nineteenth century or which could be observed even now. The following description documents these practices, but regional variations are noted in some

of them. In instances where data is available, these regional variations are also highlighted but the main focus remains on general features.

In most of the dry zone lowlands, paddy is cultivated in large plots (*Liyaddas*) demarcated by bunds (*Niyara*) but in the wet zone and in Jaffna these plots are medium in size. In the mountainous region paddy is grown in terraced fields, facilitating the maximum use of water. In these areas paddy fields consist of small bunded terraces (*liyaddas*) arranged in tiers. Depending on the elevation, the distance between the higher terrace and the lower terrace varies from about one foot to four feet.

Plate 1: Terraced paddy fields

Pre cultivation manuring techniques vary from region to region. In certain regions no pre cultivation techniques are adopted. In other areas old straw, once used for thatching roofs, is used as carbonic matter in fertilizer for paddy fields. The old straw is spread on the *liyaddas* and soaked in water. Once the water is drained, the straw is virtually pasted to the soil and when pulverized turns into good manure. The straw cover prevents air reaching the soil and therefore is also used as a weed killer.

In certain areas after each harvest, stubble and straw are burnt to make the paddy fields fertile, as well as to rid them of ground pests. In Jaffna, Hatara Korale and in several other places herds of cattle are tethered in paddy fields so that the field is cleared of grass before ploughing. The tethering of cattle in different areas of the same paddy field was also done to naturally manure the field with cow-dung. Until 1970's the herd owners in Jaffna charged five rupees per day for tethering their cattle in another's field.

Generally, paddy fields as well as *chena* lands have been measured by sowing extents (*Vapasariya*) and not by measures such as Acres, Roods and Perches. The sowing extents decided by measures are *Amuna*, *Pala*, *Laha*, *Kuruni*, and *Naliya*. The *Laha*, *Kuruni*, and *Naliya*, were in fact measures made out of wood, rattan, bamboo, palm leaves and elk hides. The sowing extents and actual land extents may vary from location to location. In a flat terrain the amount of seed required for sowing is certainly more than that required in a mountainous terrain, the length and width of which may be the same as in the former.

Cultivation seasons have been almost the same throughout the centuries. The Tonigala inscription of the fourth century A.D. refers to three crops of paddy namely; *pitadada hasa*, *akala hasa* and

meda hasa [10]. They correspond to the present *Maha*, *Yala* and *Meda* harvests respectively. In the Northern Province the Maha season is called *Kalapokam*, the Yala season is called *Sirupokam* and the Meda season is called *Idaipokam*, however it is only in the Maha season that paddy is cultivated in most regions of the North. The mud paddy cultivation of the *Maha* season begins in October and November and the harvest is reaped in about February and March. The *Yala* cultivation begins in April or May and the crop is harvested by September. The *Meda* cultivation season, usually commences in December or January. However, it should be noted that cultivation seasons vary due to the fluctuation of rainfall.

The preliminary operation in wet paddy cultivation is the eradication of the rank growth in the field boundaries and in adjacent canals. Mamoties and hoes are used for this operation. In certain regions green manure was added to the paddy field. This is done by spreading leaf matter such as *Ginibiriya* (*Sauropus rigidus*), *Keppetiya* (*Croton lacciferus*), *Bovitiya* (*Osbeckia cupularis*), *Pinna* (*Clerodendrum infortunatum*), *Kaduru* (*Sapium insigne*), *Vatabiriya* (*Droseraceae burmanni*), Jak (*Artocarpus heteropylia*), *Eramudu* (*Erythrina indica*), *Valsuriya* (*Tithoonia diversifolia*) and *Gan Suriya* (*Thespesia populnea*) over the field. Hard stems and any undecomposed matter are removed before water is diverted to the field. Other farmers manure their paddy fields with the dried dung of cattle or goats, or with compost. This traditional system of manuring paddy fields before the initial flooding of the field is in complete harmony with nature. Besides, harmful chemicals which may tend to upset the ecological balance of the environment were never added.

The paddy fields are first irrigated so as to cover the ground with about three inches of water. This is done before the first ploughing. The ground is allowed to remain under water for three to fourteen days, the time depending on the availability of water. During this period organic matter is decomposed and the *liyaddas* or bunded plots become mires of mud. The water is then allowed to pass through openings called *Vakkada* in the ridges or *niyara*.

Plate 2: *Vakkada*

The land is then ploughed for the first time. Ploughing is done in one direction upto a depth of three or four inches, using a traditional plough drawn by two buffaloes. In the northern peninsula bulls are also used for ploughing. The first ploughing is called *bin naguma* (බින් නැගුම) in Sinhala and *Ulaviraddippu* in Tamil.

After the first ploughing, a sufficient amount of water is allowed to remain in the field for upto two weeks. The ridges (*niyara*) are then cleared of grass with mammoties. A second ploughing (*dehiya*) may be done although some farmers prefer to avoid this stage. In Tamil, the second ploughing is called *marai*. The third ploughing is called *tun hiya* (තුන් හිය) in Sinhala, and *Munrandulavu* in Tamil.

Ploughs have been used in the island from pre-Christian times. Types and sizes have varied from region to region, depending on the necessity for

uprooting stumps, and retaining soil moisture for germination of seeds. The initial ploughs were made entirely of wood but later on, the metal hoe was introduced. According to some of the literary texts of the thirteenth century, the main component parts of the plough were the yoke (*viyadanda* or *viyagaha*), the plough rod (*nagul iha*), the plough hand (*nivun ata*), the handle (*nivun kurulla*), the hoe blade (*hi vala*) and the rope (*rana*) [11]. It is interesting to note that these local terms are still in use among Sri Lankan peasants.

The principal ploughs used particularly in the Kandyan areas are called the *Bandavata Nangula* (බදවට නඟුල) and *Koku nangula* (කොකු නඟුල). The *Koku nagula* is used even in the low country wet zone but it is smaller and lighter than the one used in Kandyan areas. There are two designs of this in use in the Western province known as the *tani hede nangula* (*single-shaped plough*) and *heda deke nangula* (*Plough of two shapes*). The ploughs differ in shape in front, and in the iron coulter or share with which it is faced.

Figure 3: Ploughing

Ploughs used in Jaffna differ slightly from ploughs used in the rest of the country. The shaft of the Jaffna plough is rounded and is in the form of a pole. The Sinhala shafts are usually made of *Kitul* (*Caryota urens*) wood whereas the Jaffna shafts are made of several different kinds of wood including ebony. In the Sinhala ploughs, there is a notch or two in the yoke for tying the ropes but in the Jaffna plough this purpose is served by a horizontal peg passing through the pole [12].

The Sinhala and Tamil equivalent terms for component parts of the plough are given below:

English		**Sinhala**		**Tamil**
Plough Rod	=	*nangul ata, nangul iha, patakade*	=	*Erkkal*
Yoke	=	*viya gaha, viya danda*	=	*Nukam*
Holes for the rope to attach oxen	=	*viya bâna*	=	
the rope	=	*Rãna*	=	*Kiddi*(pegs instead of rope)
the Plough Share (a)	=	*Nangul kanda, I 'ak atta*	=	*Padaval*

Plough Share (b)	=	*Koravakkole*	=	*Koluchchiray*
Hoe blade	=	*Hi vala*	=	*Kolu*
Plough hand	=	*Nivun ata*	=	
Handle	=	*Nivun kurulla*	=	*Meli*

In certain regions of the South, ploughs are not used. Instead, tethered buffaloes are driven over the muddy fields before they are levelled. This practice is called *Puran Madima* (පුරන් මැඩීම) in Sinhala and is popular in regions such as Raigam Korale, Pasdun Korale, Giruva Pattu, Magam Pattu, Morawak Korale and Hinidum Pattu[13]. However, there are some regions, particularly in the wet zone, where farmers use only the mamotty for field preparation.

The final stage of the field preparation is harrowing or smoothening the surface of the *liyaddas* and is called *Poruganawa* in Sinhala. Before harrowing, water is drained off the field by closing the openings (*vakkada*) through which water rushes. Two types of levellers are used for the smoothening process. They are the plough leveller (*nangul poruwa*) which was drawn by buffaloes or bullocks and the hand leveller (*at poruva*) which was manipulated by the farmer who stood behind it. The leveller was made completely of wood and was in the form of a board or it was a piece of wood of about four feet long to which iron spikes were fixed. The former was sometimes made of *kohomba* (*Azadirachta indica*) timber which is considered to be pest resistent. In certain instances, farmers level the ground with scrapers and mammoties without using either of the earlier mentioned implements. This process is called *goigama* (ගොයිගැම) or *madamevarakirima* (මඩමේවරා කිරීම). The day after the leveling, germinated seeds are broadcast or seedlings are transplanted. The more popular practice is the former.

The seed paddy (*bittara vi*) was selected during the previous harvest or even earlier. The selection of seeds was done well in advance because the uncertainity of the following season's crop. The best crops of both *yala* and *maha* seasons, were considered suitable for seed paddy. Seeds were selected from the best plants in the field or were harvested from selected spots.

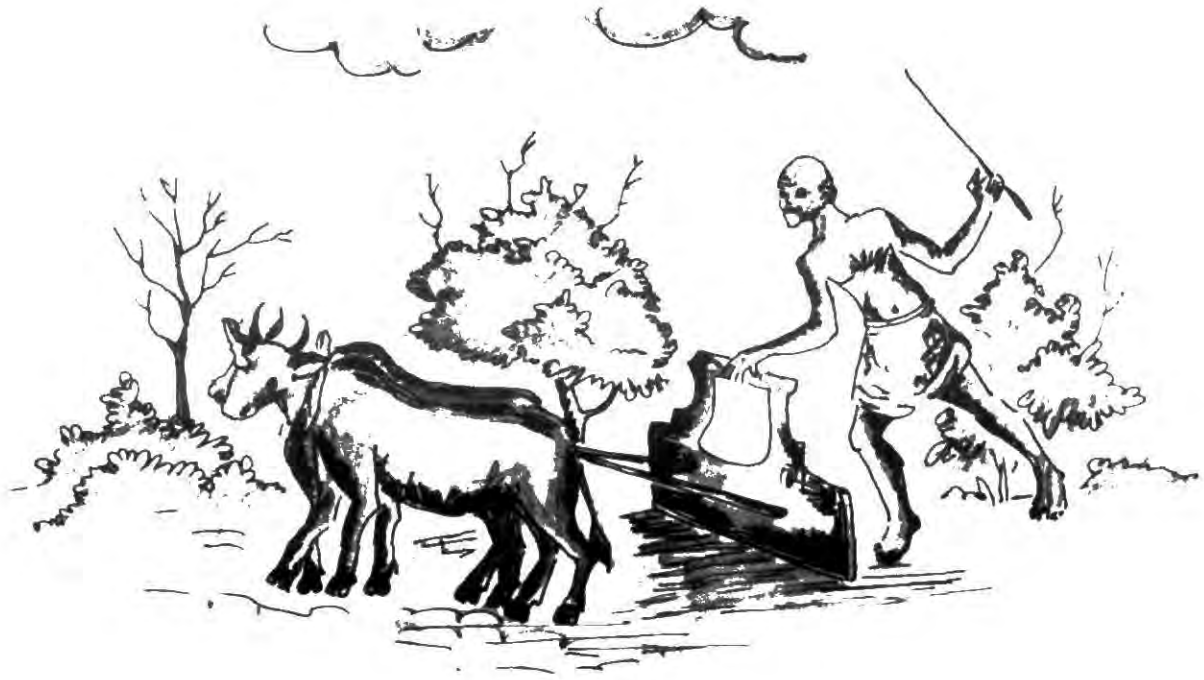

Figure 4: Harrowing

The seed paddy was then stacked in gunny bags, barrels or wooden containers. Depending on the availability, custom and usage, layers of leaves of *Kohomba* or margosa (*Azadirachta indica*), *Pangiri* or citronella (*Cymbopogon nardus*) or *Madurutala* (*Ocimum sanctum*) were placed in between paddy. These leaves were considered pest repellant. *Kohomba* seeds or *Kukurumahan* (*Randia dumetorum*) fruit were sometimes mixed with the paddy with the same objective. Some farmers in the Ampara District soaked the seed paddy in water mixed with *Kohomba* juice, before drying and stacking them in gunny bags as a means of pest control.

The vareity of paddy selected for sowing is first winnowed, to rid it of any dust particles. The lot is then soaked in water for up to 24 hours, after which the soaked paddy is spread on plantain leaves, *ala kola*, *habarala kola* (*Alacasia macrorrhiza*), *pinna* (*Clerodendrum infortunatum*), *kanda* (*Makarange peltata*) or any other similar leaves, which have been placed on an earthen floor. The heap is then covered with the same leaves and mats or gunny bags and some weights are placed on them. This is done in order to maintain the heat necessary for germination. After three days, the paddy is smeared with water dissolved with cow dung, lime, turmeric (*kaha* = *Curcuma domestica*), crushed *Pangiri* (*Cymbopogon* nardus) leaves, *ati kehel* (*Musa paradisica*) or *Labukinda*. This is done in order to rid the seeds of any residual pests. The seeds are then rearranged as before and left for another day. The germinated seeds would then be ready for sowing. Some farmers would sow seeds which have germinated well after three days, almost immediately. The heap of paddy seeds spread in this manner for germination is called a *Vi yahana* (වී යහන) or *Pala vi maluva* (පැල වී මලුව) in Sinhala [14].

Seed paddy for sowing was taken to the field in baskets made out of rattan, bamboo or palm leaves. The shape, size and mode of use of these baskets varied from region to region. The oblong shaped container was either pressed between the side of the body and the underside of the arm or arm pit, or hung from the shoulder while the shallow small container was held in one hand. Sowing was done backwards so that sown paddy was not trampled.

After sowing, and once the seeds had taken root, but before the mud dried out, the *vakkada* or openings through which water was drained were closed, and the field inundated during the day. The water was drained out however, each eveing. This was done for three days after the initial sowing. This process was repeated once in three days and continued for nine days and was called *isnan bandima* (ඉස්නන් බැඳීම) in Sinhala.

From the twelfth century onwards transplanting had been practised at least to a limited extent. The Sinhala classic *Daham Sarana* of the twelfth century refers to both systems; sowing and transplanting [15]. The seventeenth century writer Robert Knox states "Corn is grown about a span high, the women come and weed it, and pull it up where it grew too thick, and transplant where it wants." [16]

Transplanting is still practiced in Walapane, Kotmale, Hanguranketha, Tunkorale, Hatara Korale, Taman Kaduwa and Nuvarakalaviya and in several other areas. A fertile plot in the paddy field is selected as the plant bed and this plot is first manured with cow dung and compost. The germinated seeds are then spread onto the plant bed which is inundated for three days during day and drained out in the night. Once the plants sprout, the water is retained in the bed up to a height of about one inch. Plants are uprooted in 18 days or 21 days depending on the variety of seed paddy used. The uprooted plants are tied up in bunches and placed in each *liyadda* by men. Women usually do the transplanting and in doing so they maintain a distance of about six inches between two plants.

The Sinhala classic, the *Butsarana,* written in the twelfth century, states, that a skilled farmer used fertilizer to increase his harvest [17]. The types of fertilizer used are not indicated in this text. Perhaps

burnt weeds were turned into green manure or potash. The earliest clear reference to the actual application of cow-dung to the fields in South Asia is found in the Indian text *Harsacarita* of Bana belonging to the seventh century A.D. The *Harsacarita* describes a cultivator driving bullock carts filled with cow-dung and other refuse to the fields, to improve fertility[18]. It is likely that in Sri Lanka too, in that period, green manure, cow dung, and bone manure were used by farmers to increase the fertility of their fields.

Before the extensive use of chemical fertilizers in the latter half of the twentieth century, compost fertilizer was used in paddy fields, home gardens and occasionally in *chenas*. For this purpose peasants prepared a pit in their home gardens and added cow dung, dung of fowl and goat, urine of cattle, straw, leaf matter, paddy husk and ash into the pit. The dried compost was used as manure, usually carried in boxes or baskets, to be used in the field.

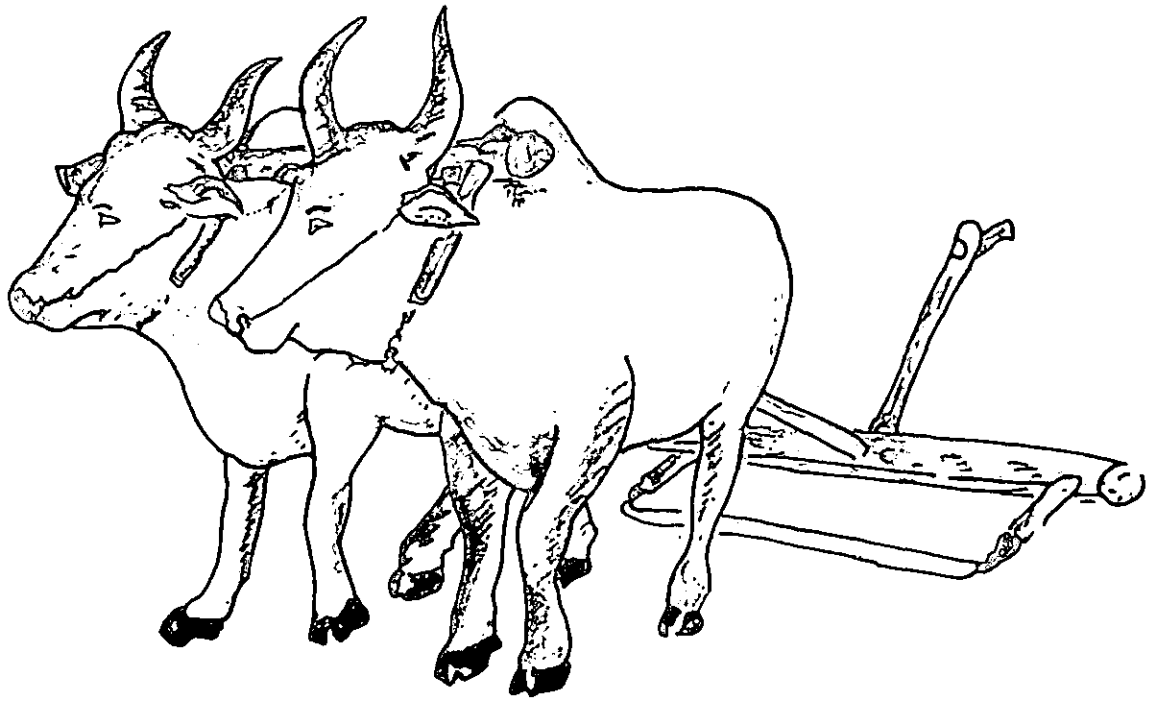

Figure 5: Plough leveller

Some farmers in remote villages in Pasdun Korale even used the refuse of bats for manuring paddy fields. This practice was not extensive until about the mid nineteen fifties, when farmers collected bat's refuse from the caves at Pahiyangala off Bulatsinhala.

Until about 1970's, in areas such as Nattandiya, Eppawala, and Kalavava and all over the Matara district, bone manure was also utilized for fertilizing paddy fields. The bones of *Bos indicus*, crushed into small particles, were considered extremely good manure for paddy. In the Matara district even fish bones were used for this purpose.

In the Daduru Oya plains, the farmers grew *Mi* (*Madduca longifolia*) trees on the edges and the centre of the paddy field. These trees provided both shade and manure, as bats were attracted to the flowers and tender fruits. Bat dung and the dried *Mi* leaves were considered good manure for the field. [19]

Weeding by hand of grass in paddy fields is a practice which is fast dying. This is propably due to the widespread use of weedicides. Prior to the Green Revolution, weeding was a widely prevalent practice and was mostly done by women.The *nelum kavi,* poems recited while weeding, have entered into the Sinhala folk tradition underlying the importance given to hand weeding by peasants.

Several species of weeds such as *Kudamatta* (කුඩමැටට), *Maratu* (මරටු), (*Panicum crusgalli*), Batadalla (බටදැල්ල) (*Isachne qustrulis*), Diyaberaliya (දියබෙරලිය), *Kirindi* (කිරිඳි) (*Eclipta alba*) grow in paddy fields and therefore weed control is absolutely necessary for a better yield. Weeding commences about three weeks or four weeks after sowing or planting.

In some areas in Pasdun Korale, pieces of sharp wood or wooden nails are fixed on to the side of a banana trunk. When the trunk is drawn over the plants, weeds such as *Kudamatta* and *Batadalla* are removed and submerged in water. This does not happen to the stronger paddy plants. These methods are environmentally friendly unlike modern weedicides, which contain harmful chemicals. [20]

Traditional methods of pest control have also been evolved from time immemorial. The ancient peasant like his modern counterpart was engaged in a constant struggle against nature while living along with nature. Therefore he believed that techniques derived from the accumulated knowledge and experience of his ancestors and effort alone could not bring the desired results from agriculture. To protect his crops from pests and from such dangers as drought and flood he believed in unseen forces, as a result of which astrology, ritual and superstition played an important part in his life.

The Sinhala as well as the Tamil and Muslim peasant started all his activities in the field such as ploughing, sowing, transplanting, harvesting and threshing at a favourable constellation. The guidance and advice of the astrologer was important in this connection and on certain days and when constellations were unfavourable, activities in the paddy field were avoided. It was considered that plant diseases and pests could be remedied or controlled by certain measures which were known as *kem*. The earliest references to *kem* are found in the thirteenth century literary works *Pujavaliya* and *Saddharmaratnavaliya.*[21]

The term *kem* is derived from the Sanskrit *Kshema* which means protection. As seen later, most of these *kem* measures have a scientific basis but the peasant would not have been able to explain them in scientific terms.Therefore, when oberserving *kem* they would chant incantations and resort to many other rituals.

In several areas, just before sowing or at the time of the plant growth, the bottom end of the coconut frond from which leaves have been removed, called *polpitta* (පොල්පිත්ත) in Sinhala and wooden poles with forklike ends, are erected in many places of the paddy field. The objective is to attract birds on to these posts. Birds, including nocturnal birds such as the owl, destroy and control harmful rodents like rats, worms and other pests. Some farmers in Hatara Korale and Kandy place coconut husks filled with sand or soil, on which are scattered seeds of green gram, in between the forks of timber poles in order to attract birds on to them.

On the other hand, the grain had to be protected from birds just after sowing and when the crop was ripening. Pineapple (*Ananas comosus*) or *Vatakeyya* (*Pandunus tectorius*) leaves on which long lines were drawn in lime were hung in the paddy fields by some farmers. These could be mistaken for snakes by the birds, who would then avoid the paddy field. In certain areas long pieces of white cloth were utilized for this purpose.

The smearing of paddy plants with ash in the morning was another form of *kem* practised all over the country. The Tamil literary texts of the thirteenth and fourteenth centuries state that the ashes of the burnt wood of a ruined house or hut were spread on the ridges of the paddy field through the belief that it would protect the crop from birds and animals. [22]

Even at present smearing ash on paddy plants in the morning is practised by many farmers all over the country. Before smearing ash, water is drained from the field and after smearing, the field is kept dry for four days. Due to the effect of ash, insects on paddy plants move downwards into the plant and on to the soil. The eggs of the insects are also wiped out by the farmer with a bundle of *Keppetiya* (*Croton lacciferous*) leaves. After four days the field is inundated again and the insects that moved down due to the effects of ash die in water.

In remote areas of the Kurunegala district, insects that harm the paddy plants were removed by burning dried leaves of *Gandapâna* (*Lantana aculeate*), *Keppitiya* (*Croton lacciferous*), *Dodampanâ* (*Glycosmis pentaphylla*) and *Sera* (*Cymbopogon citratus*). It was believed that such fumigating would dispel flies and insects.

Smearing *crushed Madu* (*Cycas circinalis*), *Valdel* (*Atrocarpus nobilis*), *Kokkana* (*Kokoona zeylanica*), *Godapara* (*Dilleniaretusa*), *Demata* (*Gmelina asiatica*) and *Kukuruman* (*Randia dumetorum*) is yet another form of *Kem* observed in different regions of the country. Most of these crushed plants give off strong odours which act as insect repellants.

The juices obtained by crushing the roots or leaves of *Katurumurunga* (*Sebavia grandflora*), *Devata* (*Carallia brachiata*), *Kapparavalliya* (*Coleus ambonicus*), *Daluk* (*Euphorbia antiquorum*), *Varâ* (*Calatropis giganta*), *endaru* (*Ricinus communis*), *Niyangala* (*Gloriosa superbe*), *Keppitiya* (*Croton lacciferus*) and *Karanda* (*Pongambia gabra*) mixed with the water in the paddy field were also used by farmers as pest repellants. It should be emphasized that some of these *Kem* measures were adopted nor only for paddy, but also for crops grown in *chenas* and in home gardens.

Some farmers in Nuvarakalaviya and Tamankaduwa prepare a concoction of සහිඳුලුණු (*Magnisium sulphate*), සීනක්කාරන් (*Potash alum*), and පල්මානික්කම් (*Copper sulphate*), and mix it with the water of the paddy field, in order to rid the field of harmful pests.

A fly catcher known as the *boku kulla*, made like a winnow with a long handle, was one among several measures resorted to by the peasants in order to protect their paddy crop from insects and pests. Various sticky resins were applied to the inner surface of the winnow and this implement was then dragged over the plants. This was done early each morning, so that the insects were disturbed and addhered to the winnow.

A similar but slightly different *Kem* measure was adopted by paddy farmers in Siyane Korale, Hopitigam Korale, Alutkuru Korale, Hanguranketha and Kotmale. A large piece of cloth was soaked in a mixture of resin (*dummala*) oil and fitted on to a rope. Before sunrise, the rope was dragged through the paddy field by two persons holding the two ends of the cloth. Insects were trapped in the sticky cloth and thus got rid of.

The oil lamp or torch *Kem* (පහන් කෙම) was another form of charm used to dispel pests. For this purpose, in most areas, tiny clay pots or pieces of seedless raw papaya (*Carica papaya*) were used as lamps. The oils of either coconut (*Cocos nucifera*), *Kohomba*, *Mi*, sesame or *Kekuna* (*Scutinanthe*

zeylanicum) was poured into these lamps and the wicks of the lamps were burnt for three nights. In some areas torches instead of lamps were used for this purpose. These torches were made of rags of cloth and were wetted with oil. Bundles of dried arecaunt and coconut leaves were also used as torches in areas such as Aranayaka, Hataraliyadda and Hanguranketha. The flies and insects that got attracted to these lights were invariably destroyed. [23]

The length of time required for the maturation of the paddy crop depended on the variety of paddy sown. Some varieties required three months, some four and some even six months. In ancient literature only a few varieties such as *Hinati, Rathal* and *Ma vi* are referred to [24]. According to these texts, *Sînäti* required three months and *mâvi* required as many as six to seven months. Robert Knox writing in the latter part of the seventeenth century referred to varieties known as *Ma vi, Hatiyal, Hondaravala, Hi nati* and *Al patka* [25]. Until the twentieth century, in addition to these varieties the Sri Lankan peasant knew and grew hundreds of other traditional varieties.

These varieties are divided into two main types *Bala vi*, and *Vadimal vi* which literally mean younger paddy and elder paddy. Younger paddy could be harvested in 2 ½ to three months after sowing. Varieties such as *Dana Hala* (දනහලා), *Sudu Hatada* (සුදු හැටඳා), *Sudu Vi* (සුදු වී), *Horanavalu* (හොරනවාලු), *Kulukuru* (කලුකුරු), *Hi Nati* (හී නැටි), required about two and half months for maturation while varieties known as *Bâlangoda* (බාලංගොඩ), *Bâla kiri* (බාල කිරි), *Kottiyâran* (කොට්ටියාරං), *Bala Panniti* (බාල පන්හිටි), *Ratu Suduru* (රතු සුදුරු), *Suduru* (සුදුරු), *Kottatavala* (කොට්ටතවාල) and *Murunga* (මුරුංගා) required three months. All these varieties were usually cultivated during the *Yala* season. If however the rains failed in any year, then these varieties were cultivated in the *Maha* season as well.

Some of the varieties which required four to four and half months for maturation were *Atarali Samba* (අතරලි සම්බා), *Ahunal* (අහුනල්), *Âtiyal* (ආටියල්), *Kahavanu* (කහවනු), *Kalu Vî* (කලු වී), *Kiri Vî* (කිරි වී), *Kuru Bâla Vî* (කුරු බාල වී), *Kocchi Vî* (කොච්චි වී), *Goda Mâ Vî* (ගොඩ මා වී), *Danduväl* (දන්දුවැල්), *Podi Sudu Dahanalâ* (පොඩි සුදු දහනලා), *Batu Kuru Vî* (බටු කුරු වී), *Bâla Ratu Vî* (බාල රතු වී), *Maha Madol* (මහ මඩොල්), *Mulanâi* (මුලනායි), *Suvandäl* (සුවඳැල්) and *Hata Panduru Vi* (හැට පඳුරු වී).

The varieties known as *Heen Sudu Hatili* (හීන් සුදු හාතිලි), *Heen Ratu Vi* (හීන් රතු වී), *Heen Dik Vî* (හීන් දික් වී), *Hapumal* (හපුමල්), *Sultâni* (සුල්තානි), *Sudu Handiram* (සුදු හන්දිරම්), *Sudu Mal* (සුදු මල්), *Siri Vî* (සිරි වී), *Ran Pot Vî* (රන් පොත් වී), *Ratmada al* (රත්මඩ ඇල්), *Mutu Manikkam* (මුතු මාණික්කම්) and *Kaba Náran* required five months for maturation.

Some of the purely *Maha* varieties which required six months or more for maturation were *Ahaskâra* (අහස්කාර), *Al Vî* (ඇල් වී), *Udarata Samba* (උඩරට සම්බා), *Karal Nämû Vî* (කරල් නැමු වී), *Kahata Al Vi* (කහට ඇල් වී), *Kalu Vî* (කලු වී), *Kalu Kumara Mâ Vî* (කලු කුමාර වී), *Kiri Samba* (කිරි සම්බා), *Kolombâ Vî* (කොලොම්බා වී), *Kohu Vî* (කොහු වී), *Goda Mâ Vî* (ගොඩ මා වී), *Tatuvel* (තටු වෙල්), *Puruk Vî* (පුරුක් වී), *Madayal* (මඩයල්), *Mal Ratu Vî* (මල් රතු වී), *Manel Vî* (මානෙල් වී), *Sudu Kohu Mâ Vî* (සුදු කොහු මා වී) and *Hatiyal* (හාතියල්). [26]

Whichever the variety grown, harvesting paddy in all regions of Sri Lanka was done with a metal sickle (*dakatta*) which had a handle made of wood. In shape and size the sickle too had its local variations. The initial reaping was done at an auspicious time (*näkatha*) and certain rites were performed. These rites included respectfully bowing to the ears of paddy. The ears of paddy were then reaped and taken on the farmer's head to the threshing floor known in Sinhala as *Kamata* or *Kalavita* and in Tamil as *Kalam*. Wednesday was avoided by Tamil and Muslim farmers for reaping while the Sinhala farmers avoided both Wednesdays and Saturdays.

In all regions, reaping operations were done by men and reaped paddy was spread out in the sun for two or three days to make them completely dry. Once dry, the crop is removed in bundles to the threshing floor.

Elaborate rituals connected with paddy cultivation were performed on the threshing floor. Before the paddy was brought in for threshing, a pit of about three feet deep and half a foot in diameter was dug in the centre of the threshing floor. This was called the *Arakvala* or the protection pit and it was meant to protect the harvest from unseen forces or spirits. These spirits were called *Bahirava* in Sinhala and *Kuli* in Tamil. Items such as betel, arecanut, coconut, a bronze plate in which charms (*Mantra*) had been written, a piece of turmeric, a piece of *Kohomba* wood, a piece of iron, bronze coins, sea shells, leaves of trees such as *Divikaduru* (*Rejona dichotama*), *Nika* (*Vitedx negundo*), *Bo* (*Ficus religiosa*) and *Iluk* (*Imperata cylindrica*), a small round stone (*arakgala*) along with some ears of paddy were then placed in the pit. The placing of these items in the pit was also done at an auspicious time.

Figure 6: Threshing paddy

Once the pit was closed, the trident (*trisula*), an arrow, and a sword symbolizing various charms (*Kamat Yatura*) were drawn with ash on the surface of the pit, in three concentric circles. This stage of the ritual was called the *aluhan täbima* or ash placing ceremony. Ash for the purpose was obtained either from the domestic hearth or burning dried *kumbuk* (*Terminalia glabra*), *agil* (*Aquilaria agallocha*), citronella and cow dung in the paddy field itself. [27]

In Jaffna, threshing rituals are slightly different and the farmers there encircle the whole threshing floor with leaves or pieces of bark of margosa and some creepers known as *pirandai* (*Vitis quadrangularis*). An extempore image of *Ganesha* made of cow dung or soil is also worshipped and rituals associated with splitting of coconut are also conducted. Instead of making a cavity in the centre of the threshing floor, a stake of a hard wood with a few ears of paddy and margosa leaves is placed in the centre as an instrument of protection. The ears of paddy are heaped round the stake for threshing. [28]

The crop stacked in paddy fields after reaping, is removed in bundles to the threshing floor by women. The bundles are then arranged around the threshing floor in large stacks or sheafs called *Kola*. This is done by the men. These stacks are spread a little at a time, on the floor at the time of threshing. Threshing is usually carried out in the evenings and the night. Moonlight was preferred for this purpose. The process was completed in the following morning. The spreading of paddy on the floor for threshing is called *Uppida täbima* (උප්පිඩ තැබීම), *Mitiya bäma* (මිටිය බෑම), *Goyam bäma* (ගොයම් බෑම) and *Kola elima* (කොළ එළීම) in different regions. [29]

In most regions threshing is carried out with buffaloes. Depending on the amount of paddy to be threshed, two to five buffaloes are tethered together in a row and tied on to a stake in the middle of the threshing floor. Then they are driven round the floor. In certain instances, two sets of buffaloes are driven one after the other. As the number of buffaloes in the Vanni region and the Jaffna Penninsula are limited, even neat cattle are used for threshing. In these areas sometimes a buffalo is teathered together with a neat cattle bull. If the animals void dung while threshing, it is removed with a little straw placed on upturned palm of the hand of those who drive the animals and then thrown beyond the threshing floor.

Two or three hours after threshing; the ears of paddy are tossed and arranged for further threshing and the grain loosened with an implement known in Sinhala as *Ukumi datta* (උකුණු දැත්ත), *Koladebala* (කොළදෙබළ), or *däti goiya* (දැති ගොයියා). The term *goiya* means cultivator. In Tamil it is called *Velai al* or *Velay karan* meaning labourer. This implement is a thin long pole of strong wood about five feet

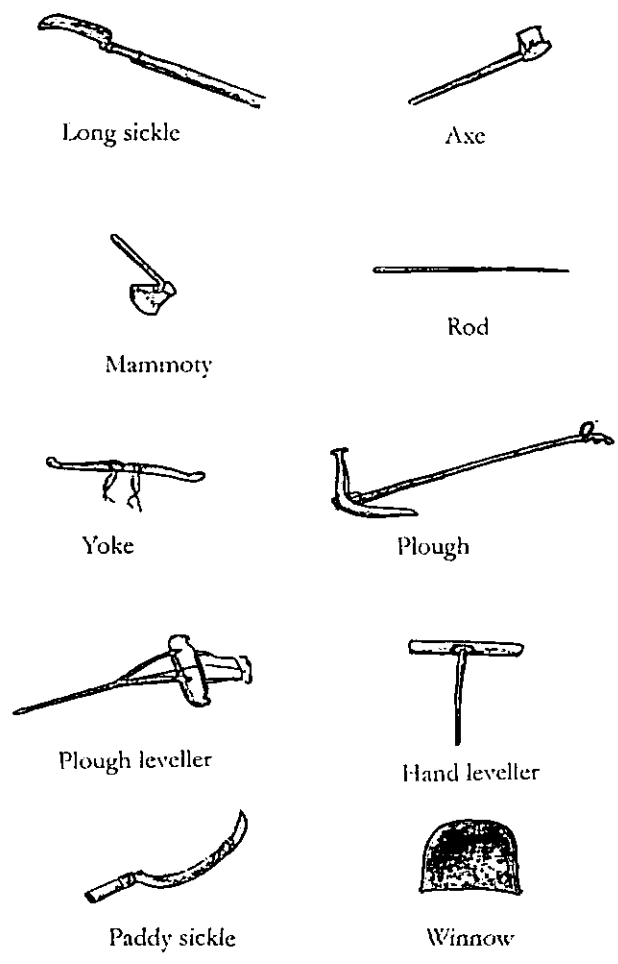

Figure 7: Some Traditional agricultural Implements

long. The end of it is sometimes fitted with a metal hook. Otherwise it is of natural strong wood bent upwards at the end. Another wooden implement shaped like a cricket bat, known as the *Kola patta* (කොළ පත්ත), was used to beat the edges of the corn in the stack, so as to level the surface of the stack to facilitate threshing. Once the paddy is threshed, the straw is removed from the threshing floor with the help of the same implement and stacked on a side of the floor.

The traditional implement used for removing chaff from the threshed paddy is the winnow called *Kulla* in Sinhala. After the usual rituals, mats are spread on the side of the threshing floor exposed to the wind. Paddy is then poured from the winnows along the windward edge, so that the chaff flies off to leeward, leaving the grain in a heap. The paddy is sometimes poured down from a high platform which is erected on two posts. This method was prasticed in all regions including the Jaffna Peninsula and the Vanni region [30].

Thereafter, paddy was allowed to dry on the threshing floor or was removed to the farmer's house. The dried paddy was subsequently stored either in the *hissa* (a round rice storage vessel) or *atuwa* (a cubical barn).

At least five methods of labour utilization in paddy cultivation are known. In the first method the owner works the land himself together with his family. Additional labour required during the ploughing, harvesting and threshing stages is obtained by paying labour on a daily basis. The second method is the employment of paid labour for the whole period of cultivation. The third method is payment on a share cropping basis or *ande* tenure per season or for several seasons. The fourth and the fifth are the systems known as the *attan* and *kaiya*.

Historically, the gentry and those engaged in occupations other than agriculture, entrusted the cultivation of their land to farmers on the *anda* tenure. This method was also practised in relation to monastic lands. The term *anda* similar to the Sanskrit term *ardha* and the Pali term *addha*, which means half, occurs in Sinhala literature from the thirteenth century onwards. The tenant who cultivated a plot of land held by another had, according to this system, to pay half the crop to the latter. In certain cases, the crop was divided in the proportion of one-third for the land holder and two thirds (*tun ande*) for the tenant cultivator [31].

Presently, there are two main *anda* agreements followed by the tenant and the cultivator. According to one, the landlord and the tenant share the cost of the seeds and buffaloes and divide the harvest equally. According to the other, the landlord provids all the expenses for seeds and buffaloes but all those expenses are reimbursed by the tenant after the harvest. In addition to this, the crop too is shared on a fifty fifty basis.

The fourth and fifth methods of utilization of labour for paddy cultivation are the systems known as the *attam* and *kaiya*. The term *attam* refers to the reciprocal exchange of labour by which one person works in another's field and the other reciprocates when the first person requires his assistance. The crux of the system is balanced reciprocity, as it consists of a series of voluntary contracts between sets of individuals which stipulate the duration, nature and type of labour to be exchanged. Though the contract is never one between two groups or an individual and a group, it is not a fragmented pact between two individuals. This system is of great social value as various individuals are involved with numerous others when contracts for the exchange labour are made. [32].

The *Kaiya* is a distinctly separate institution for organizing labour. It was not always reciprocal and was used not only for wet paddy cultivation but also for certain operations in *chena* cultivation such as harvesting *kurakkan*. Women were also mobilized in the labour force in *Kaiya* operations, whereas in the *attan* arrangements only men were used in the exchange of labour. The peasants who did not possess their own land also participated in *Kaiya*. In such cases, there was no exchange of labour, but the other reciprocated after the harvest with a few measures of paddy or *kurakkan*. In the recent past, fields belonging to the *Gamarala*, *Village Headman*, *Vel muladani*, village physician and even the village astrologer were cultivated with labour obtained by the *Kaiya* institution. The *Kaiya* system was therefore not always tied to the reciprocal exchange of labour.

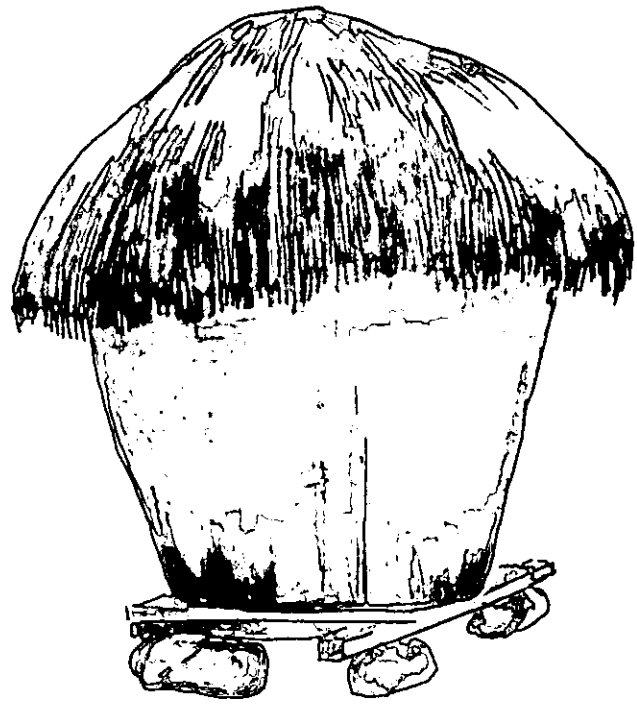

Figure 8: *Vi hissa*

As Karunanayake [33] has pointed out, the mobilization of *Kaiya* labour at the village level, could also be done for the construction of a road or the digging of a community well. Thus, *Kaiya* is a form of mobilization of labour which may be used at the level of the individual or that of community. It is possible for an individual to work his fields by mobilizing *Kaiya* labour, but the cardinal principle at the level of the individual is that there should be justifiable grounds for the invocation of such labour. The operational exigencies arising for reasons beyond an individual's control such as sickness, ceremonies of the life circle and death of a family member illustrate this point. Therefore, the interdependence arising out of *Kaiya* is more long-term oriented.

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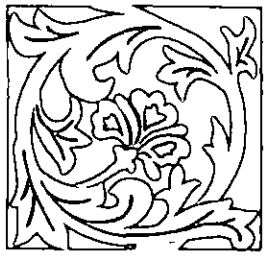

CHAPTER II

ANIMAL HUSBANDRY: BUFFALO AND CATTLE REARING

Introduction

The main focus of this chapter is on the most important aspect of traditional animal husbandry practices in Sri Lanka namely, buffalo and cattle rearing. The conventional belief that rearing of buffaloes and cattle started in the island in the middle of the first millennium B.C. with the arrival of Indian migrants needs to be re-examined, as the domestic developments have been completely neglected in such propositions.

The occurrence of fossil buffalo teeth in the gem sands of the Ratnapura area, at depths from six to thirty feet below the surface, suggests that wild buffaloes were abundantly found in that area in pre-historic times. In the Dry Zone jungles, buffaloes and cattle would have been found in greater numbers as suggested by various fossiliferous deposits in the region [1]. It may be assumed that during the Mesolithic age semi-pastoral tribes living in the island, domesticated cattle for dairy purposes as in India [2]. The early settlers who migrated from India and colonized the island by vanquishing these tribes in the sixth century B.C. were an agricultural people and they started settled agriculture in the Dry Zone. Most likely with their arrival the use of domesticated buffaloes and cattle for agricultural and dairy purposes became widespread.

The number of domesticated buffaloes and cattle had increased by the fourth century B.C., as indicated in the *Mahavamsa* the chronicle of ancient Sri Lanka. It refers to cowherds in a village at Dvâramandala, in the South-Eastern part of the Dry Zone [3]. The *Mahavamsa* also refers to a caste of cowherds supposed to have existed in the fourth century B.C. [4]. Most likely it was the evolution of this social group which resulted in the formation of the *Patti* caste, a subcaste of the *govi kula* in the sixteenth century and later. By the fifth century A.D. *Buddhaghosa*, the Pali commentator, refers to the manner in which a sagacious herdsman should rear cattle [5]. Subsequently several inscriptions, literary texts and foreign notices on Sri Lanka refer to buffaloes and cattle and their importance in the island's economy.

Although the Sri Lankan society during historical periods was not static, husbandry practices do not seem to have changed much throughout centuries until the mid-twentieth century. Neither do they have strikingly contrasting differences. The use patterns have also changed only slightly. However, with the population increase, the decrease of the man-land ratio and the introduction of modern machinery and techniques to paddy cultivation, and the mechanization of milk processing techniques etc., traditional husbandry practices are presently going through a change. Therefore documenting the traditional practices becomes absolutely necessary.

The indigenous buffalo types in Sri Lanka are the swamp buffaloes. From about the middle of the twentieth century, Indian river type buffaloes such as Surti, Murrah, and their crosses have been introduced into the island.

The indigenous cattle are small zebu cattle known as *batu harak*, but imported breeds and their crosses have increased the cattle population in the island. About 75% of the animal types in the Dry Zone are indigenous cattle but in the upcountry, mid country and wet lowlands breeds such as Ayrshire, Friesian, Jersey and their crosses are predominant.

The practice of naming buffaloes is not widely prevalent. However, while ploughing and threshing even buffaloes are addressed with respect indicating familial relationships such as mother (*amma*), father (*appa*), and son (*puta*). Sometimes addressing forms such as king (*raja*) are also used. It is also not uncommon to address them as gods (*deiyo*). But most cattle are named for identification as well as to establish contact with the animal. They are named according to their colour such as red one (*Ratta* or *Ratti*), white one (*Sudda* or *Suddi*), black one (*Kalla* or *Kalli*), spotted one (*Kabaraya* or *Kabari*) or according to a physical deformity such as short one (*Kota*) and *bandia* (Bellied one). Both buffaloes and cattle are considered movable assets and depending on the region and location they form an important item of property. Among the farming communities both in the Dry Zone and the Wet Zone particularly in remote rural areas when daughters are given in marriage buffaloes and cattle are also given to the sons in law as "dowry".

Rearing Practices

In a dry zone village in the past, as in the present, village houses were ordinarily located immediately below the tank bund, so that they were situated between the tank and the fields. Fruits and vegetables could be grown in the home garden and most of the highland surrounding the village was used for cultivating legumes, vegetables and some coarse varieties of grain. The cultivation in such tracts was practised by slash and burn techniques on a rotational basis, so in each season there was a substantial portion of land which remained uncultivated and was used as grazing ground. Besides, cattle were allowed to graze in the fields overgrown with grass during the months they remain fallow. Straw was also used as a principal item of fodder.

But in times of drought large herds of cattle had to be driven to jungles for grazing. In such circumstances the herdsman played a very important role in the livestock industry. The *Papancasudani*, written in the fifth century A.D. makes a clear distinction between the owners of cattle (*gâsâmika*) and herdsmen (*gópâlaka*). [6]

The *Papancasudani* is the best source available for a proper understanding of the grazing patterns in pre-colonial Sri Lanka. According to this text, it was the duty of the responsible herdsman to know the exact number and the different colours of cattle in his charge in addition to knowing the

symbols branded on them. When grazing cattle, he was expected to take the herd to the same spot only once in five or seven days, which means that he had to change the venue of grazing. Obviously this was necessary to allow new grass to grow in pasture lands. He also had to select suitable spots in rivers or fords when cattle were to be taken for water. When quenching their thirst, particularly during times of drought, the herdsman had to ensure that the stronger and bigger animals did not obstruct the smaller and weaker ones. The *Papancasudani* also admonishes the herdsman to look after the leader of the herd (*goparinâyake*) by giving special attention, by providing it with good food and massaging its body, so that it would protect the herd always. [7]

During the time of the Kandyan kings, in the Nuvarakalaviya region, forest land surrounding a village was used for rotational *chena* cultivation exclusively by the peasants who had shares in the village tank and fields. But when certain area of this forest land was not used for *chena* cultivation, cattle of adjoining villages were permitted to use it as pasture land [8]. In certain regions of the northern province, where land space was limited cattle were folded in shady pens and well-enclosed fields except on occasions in which they were used for draught purposes. [9]

Natural pastures are presently used for grazing buffaloes in the Dry Zone during the day. At night they are paddocked closer to homesteads. In the Dry Season buffaloes are fed with straw in the paddocks. Nearby pools are used for wallowing the animals.

In many areas of the intermediate zone such as Kurunegala and in colonies coming under the Mahaveli scheme where cultivation is intensive, grazing land is limited particularly, from the time of sowing until harvesting. During this period, small herds are tethered in home gardens but large ones are driven into the jungles for grazing, when professional herdsmen are employed for surveillance. After the harvest, buffaloes are brought back to the fallow paddy fields and allowed to feed on the stubble. Around the irrigation schemes animals belonging to several owners graze together.

In the wet zone and mid country, buffalo management is intensive. Herds are usually smaller in size and are kept in sheds near the homesteads at night. During the day, animals are tethered on roadsides, vacant land, in fallow paddy fields or near the houses. When tethered near households, feed includes household refuse, such as banana stems and jak fruit, in addition to rice straw, tree fodder, legume straw and grass. Due to various factors, particularly due to the limitation of grazing ground and the expansion of the cultivated land the buffalo population is diminishing gradually. For example during the pre-Mahaveli era, the present system C and H areas were sparsely populated. There was then sufficient jungle and scrubland for grazing of buffaloes, as well as cattle. Large herds were common and there were owners of more than one hundred heads of buffaloes or cattle in one herd. Large herds have decreased in these areas as grazing and wallowing areas have dwindled under the Mahaveli scheme. Large herd owners have sold a great number of animals to outsiders. Although during off cultivation periods animals could be kept in paddy fields, half an acre of dry land given to settlers for homesteads is inadequate for large scale rearing of buffaloes and cattle.

Cattle are managed extensively in the Dry Zone. Each morning the herds, except calves below 3 months of age, are herded to communal grazing grounds. These grazing lands are sometimes located a few kilometres away from the farmer's dwelling. The herds are sometimes moved from one grazing ground to another. Animals in small herds, of about 2 to 8 in number, are tethered and grazed in vacant plots closer to the homesteads. The animals are allowed to graze for 7 to 8 hours and are herded back in the evening. All animals, except lactating cows, are kept in a paddock. The paddocks are usually timberd enclosures. A few have roofs and the roofs of most paddocks are covered with zink sheets, straw or coconut leaves.

Calves of lactating cows were kept in a small shed called the *rahuge*. The calf was generally sent twice a day to the mother cow for feeding but sometimes owners allowed free suckling. Lactating cows were tied to a post or a tree in the paddock.

In the coconut triangle and wet lowlands, there is integration of crop and livestock. In both zones animals are grazed or are tethered on the fallow paddy fields, natural pastures under coconut plantations and in non cultivated area including common land. This is supplemented with grass cut from roadsides, tank bunds and vacant plots. Coconut poonac and some bran are also fed.

In the up country 1200 metres above mean sea level as well as in the mid-country, two systems of cattle rearing operate, the tea estate based system and the village based system. In the tea estate based system, dairy cattle either European breeds or their crosses are reared. The numbers are small and therefore they are kept in enclosed sheds next to line rooms. Feed resources are obtained by cutting grass from pastures in the tea plantations. Concentrated feeds such as poonac and rice bran are also fed to animals. In the village based system, the majority of small holders are crop-livestock farmers growing vegetables and paddy. (10)

Particularly in the upcountry and mid country, those who do not possess buffaloes and cattle practice the *anda* system. This system is practiced by farmers in order to get the possession of calves. According to this system, a person obtains a cow or a few cows or a she buffalo or a few she buffaloes from persons who have excess animals which could be used for rearing. In such cases rearing was the responsibility of the latter. When calves were born, the first calf was given to the owner and the second kept by the person who maintained them. Milk was shared alternately by the owner and the rearer. In the case of buffaloes, the first two calves were given to the owner and the third calf kept by the rearet.

Cattle hire is predominant among Tamils in the Jaffna, Vanni and Batticaloa districts. But for ploughing, harrowing and threshing, buffaloes are hired, even in other areas of the country. Historically, particularly during the period of the Kandyan kings and during the British rule, bullocks were hired by Muslims, chiefly for purposes of transport. These people collected commodities such as spices from the interior for trade in the low country, and these were carried for the journey either in carts or on *tavalams*. On their return journey they brought salt, coconut, dried fish and other commodities to the interior provinces, also for purposes of trade. Looking after the bullocks during the period of hire was the sole responsibility of the hirer.

According to *Tesavalamai*, which contains the traditional laws and customs of the Tamils; when a person hires beasts for ploughing or threshing, the owner is not obliged to replace the hired animals in case they fall sick. On the other hand if hired beasts die due to natural causes, or get hurt while in the custody of the hirer, the owner could not claim any indemnity and had to consider the loss or injury as accidental. (11)

Branding

Branding of cattle and buffaloes as a means of identification had been a practice at least from the early centuries of the Christian era. According to the fifth century A.D. Pali commentary *Papancasudani,* cattle were branded with identification marks in the shape of the trident (*trisûla*), an arrow and other objects. The same text indicates that the herds of some individuals at the time consisted of more than a thousand animals. [12]

In the nineteenth and early and mid twentieth century cattle brand marks consisted of letters indicating the name and the village of the owner. Besides, various symbols were impressed on the right hip of the animal so as to indicate the caste ranking and social status of the owner. Every social status group was assigned by custom a particular symbol. For instance, the *Vanniunnehes* or the noblemen and those of the higher echelons of the *govi* caste had as their status symbols among others, the lotus flower (*nelum mala*), the book which contains Pali stanzas known as *Pirith* (*pirith potha*) and the yoke (*Viyadanda*) and the crescent with the leaf of the Bodhi tree (*bópath adahanda*). The *vellalas* of the north also had similar status symbols such as the purse (*pahimbiya*) and the purse with the lotus (*nelummal pahimbiya*). The symbols assigned to the washermen were the washing stone (*kola mugura*) and the large pot (*wadibäliya*). The symbol of the black smiths was the plier (*anduwa*) and the fisher caste had symbols such as the boat (*oru hana*) and the billhook (*bilikatuva*). The scissor (*katura*) indicated the tailors whereas the drum (*beraya*) and the bell (*seenuva*) were assigned to the tom tom beaters. The Muslims had symbols such as the crescent (*adahanda*) and the dagger (*kaduwa*). The animals owned by the Buddhist priests were branded with the fan used by them (*vatâpota*).[13]

The branding was normally done when the calf was eighteen months old. A red hot iron was used for this purpose. Apart from the need to identify and prevent stealing, indigenous physicians or *vedaralas* had used different kinds of branding for therapeutic purposes.

As the process was painful to the animal, in certain villages in the Badulla district, juice of a plant known as *badulla* (*Senicarpus coriacea*) was applied to the skin of the animal to make brand marks. Juice exudes spontaneously from natural fissures in the bark of the tree or when the bark is wounded. This is known as *badulla kiri*. The juice which is white at first becomes black after exposure to the sun, hardening into masses of different sizes. The fresh juice is very acrid, and when applied inflames the skin and produces pastules. [14]

Particularly for purposes of enumeration, the British colonial government initiated the practice of appointing Cattle Registrars or *Udayyars* for superintending the branding of cattle. Regulations relating to the branding of cattle were made under the provisions of section 4 of the Cattle Ordinance, 1898. This Ordinance was amended in 1917 and since the 1920's the Government had made some efforts to formulate a uniform scheme of branding.

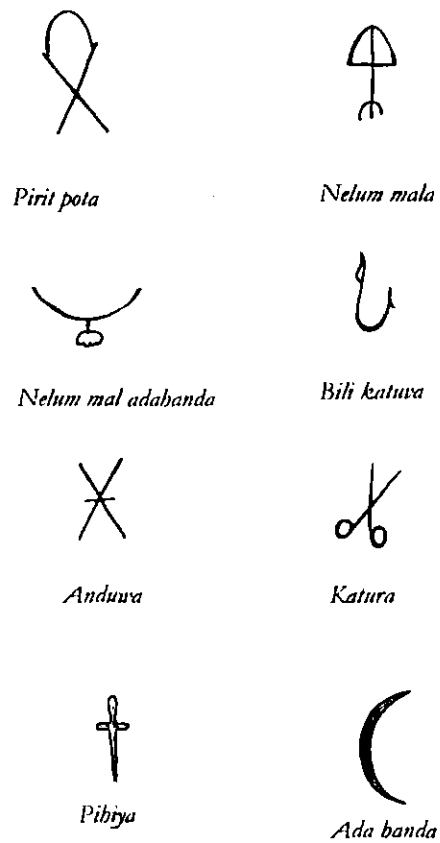

Figure 9: Some cattle Brand Marks

As a result of these measures, branding had to be done in the presence of an authorized officer, usually a Cattle Registrar or a village headman, and registers had to be maintained by the officer concerned [15].

Although regulations do exist, they are not enforced now and cattle branding is not commonly practiced. Branding as a mark of identification is still practised by some owners, but symbols indicating caste are not used now. English or Sinhala letters indicating ownership are branded on certain beasts but in government farms tags identifying the animals are fitted on to the ear.

Utilization of Buffaloes and Cattle

Buffaloes had been used throughout history, for ploughing and to compact the soil of the rice fields before sowing the paddy. They also had been used in threshing paddy. In the Jaffna District, oxen or bulls were also often used for agricultural operations. These traditional practices continue even now to some extent, irrespective of the introduction of tractorization in 1945/46. 150 four wheel tractors left behind by departing British military authorities were used initially. Two-wheel tractors were introduced at a much later date, around 1973. Of the total number of buffaloes in the island only about 40 percent had been used for cultivation purposes in 1980 [16]. Over the last 25 years this percentage also had decreased even further.

The utilization of buffaloes for farm work varies from place to place. In general, buffaloes can be utilized in four important stages of paddy cultivation namely, ploughing, puddling, leveling and threshing. These vary according to the soil conditions, the size of ridges or *liyaddas*, the geographical location of the paddy field, its accessibility by tractors and the types of farm power available. Buffaloes are generally tied abreast in pairs for ploughing and leveling, and in groups of 4-8 for puddling.

In certain regions, the animals are used for all four key stages of paddy cultivation. In certain others they are utilized for the first three stages of cultivation but in threshing they are replaced by tractors. There are still some other regions where tractors are used for initial ploughing and threshing but where buffaloes are used for puddling and leveling.

Comparatively larger hooves, more flexible pastern and fetlock joints, better ability to work in deep mud and the slower, ponderous gait of the buffaloes are the advantages of this species over cattle in the type of work associated with paddy farming.

The utilization of buffaloes for milking is not uniformly practised in the island. In Hambantota, Batticaloa and Polonnaruva districts buffloes are commonly used as dairy animals and to a lesser extent in Trincomalee, Matara, Kalutara and Ratnapura districts. On the whole only about 13 percent of the island's buffalo population is utilized for milking [17]. Milk thus obtained is largely utilized for the purpose of making curd and ghee and to a lesser extent for domestic drinking.

In areas where buffaloes are milked, the calf is separated from its mother at night and the cow is milked in the morning. Milking is done with the right hand. Before milking, the calf is allowed to suckle for a while and then separated again. After milking the calf is allowed to suckle freely during the day.

Curd making is a cottage industry. Most producers prepare curd with the milk of their own herds. Only a very small number produce curd from milk bought from others. For curd making, the milk

is usually boiled within three hours after milking, though at times this was done within an hour. The milk was boiled for 20 to 30 minutes and then cooled.

Firewood was always used for the hearth in curd making. Aluminium containers, because they were large, were used by the majority of curd makers, although a few used clay pots. Before the boiled milk cooled completely and while the milk was still warm, a little curd from an earlier preparation called *muhun* was added into the pots. The source of the starter culture or *muhun,* was obtained from previously prepared curd, half to one day old. The starter was mixed with un-boiled water before it was added to the new curd. The temperature of the milk at the time when the *muhun* was added was determined by experience.

The minimum period required for satisfactory curdling after inoculation was 3 to 5 hours. Small new pots were used for keeping curd. The pots were washed and dried before the curd was put in. The quality of the curd was determined by its firmness and flavour. The domestic consumers who prepared curd for their own consumption allowed the curd to stand from 36 to 72 hours before consumption.

The liquid that remains after the curd has formed is known as whey (buttermilk) or *yoda.* It is also known in Sinhala as *moru,* is considered a healthy drink and is consumed in the morning by some villagers. [18]

The milk of both buffaloes and cattle is used for the preparation of ghee. The milk is skimmed and the fat extracted. This skimmed milk is used in the preparation of ghee, which is used as an oil for cooking and to flavour rice. In historical times particularly in Hindu temples, ghee was also used for burning lamps. In the preparation of ghee, milk fat is heated for about 12 hours and ghee is decanted from the heated milk.

Unlike the buffaloe, the preferred use of cattle was for milk. In the whole range of Pali and Sinhala literature there are many references to the five products of the cow (*Pancagorasa* in Pali and *Pasgorasa* in Sinhala). These are milk (*kiri*); curd (*di*), whey or buttermilk made by churning curd (*yoda*), ghee (*gitel*) and butter (*vendeni*). Butter making is almost non existent now as a cottage industry because of the availability of imported and locally factory produced butter.

Traditionally bullocks were used extensively as draught animals for transport. The chief means of long distance transport for ordinary people until the introduction of mechanized motor vehicles in Sri Lanka was the cart drawn by bullocks. References to bullock carts (*gäla*) and draught oxen are found in the chronicles, literature, inscriptions and the writings in the pre-colonial and colonial period. Before motorization, wide roads were known as *gäl maga* and the bullock cart as *gala* or *sakata.* Although fast diminishing, even at present, the small carts drawn by a single bull or large carts drawn by two bulls are not uncommon in many areas including some urban enclaves. Until recently in the coconut triangle the cart known as *tirikkale* was used for human transport.

Apart from being used as draught animals drawing carts, bullocks were also used as pack-animals for the conveyance of commodities in bulk over long distances. Bands of such pack animals were referred to as *tavalam* and they were commonly used by organized groups of mercantile communities in the past. There are references in ancient and medieval inscriptions and literature to traders transporting commodities in this manner. This *tavalam* mode of transporting commodities is referred to by several writers of the subsequent periods [19]. During the time of the Kandyan

kings it was mainly the Muslims who transported the king's grains on pack-oxen and traded in salt and other commodities such as dried fish, brought from the coastal areas [20]. When Major Forbes visited the Dry Zone in the early nineteenth century, he found several Muslim traders returning from the coast with salt, conveyed upon droves of loaded bullocks. He states that these were the only beasts of burden used for transporting commodities at the time [6]. Even in modern times, despite the development of an advanced communication system with motorable roads and railways the importance of pack-animals has not diminished completely. Today the *tavalam* is not an uncommon site in certain remote villages with different terrain such as Meemure off Matale, Gonagantenna off Hanguranketa and Galdebokka off Hasalaka. When *tavalams* need more than a day to travel to their destination, they are stopped for the night and the packs are taken off the bulls. Traditionally night stops are close to *ambalams.*

Apart from being used for transport, bullocks were also used for operating contrivances known as *Cekku* in Tamil and *Sekku* in Sinhala. These contrivances were used for crushing oil out of coconuts and oil seeds such as mi, gingelly and margosa. According to Emerson Tennent, who had observed the manner of crushing the coconut for extraction of oil, in the Jaffna Peninsula in the nineteenth century, they "erect their creaking mills under the shade of the groves of the palm trees near their houses.These consist of the trunk of a tree hollowed into a mortar, in which a heavy upright pestle is worked round by a pair of bullocks yoked to a transverse beam"[22]. In the rest of the country too, similar techniques prevailed until the recent past. A large stone contrivance, which has been a part of a *sekku* is shown in an illustration.(Plate 3) This can be seen in situ in a house garden at Senaratpura in the Kundasale electorate in the Kandy district. The wooden portions of the *sekku* have been completely decayed.

Although there is some archeological evidence to suggest that beef was consumed at certain periods in the early history of the island, there are no grounds to assume that cattle were ever reared exclusively for meat in ancient times. Among the animal bones found at Gedige Anuradhapura in recent excavations, there were specimens of *Bos* (cattle) approximately datable to a period between 400 B.C. and 200 A.D. [23] Since these specimens display marks inflicted with metal knives and ash and charcoal deposits were found in association with them, it is reasonable to believe that they are food remains. However the consumption of beef had been considered extremely base since circa first century A.D. [24]. Historically, "high caste" Sinhalese considered eaters of beef as being

Plate 3: Stone Mortar of an oil mill

low and unclean. Since artifact assemblages indicate that the occupants of Gedige possessed a relatively high social status, it appears as if these prohibitions on beef eating were introduced into the island somewhat later. Remains of *bos indicus*, at times possessing knife marks have been found also at Arikamedu in South India in eras ranging from the pre-Arretine phase to 100 A.D. as well as within a megalithic culture context in India [25]. Thus it seems that beef was eaten during the period 800 B.C. – 100 A.D. by the average person in Peninsular India and Sri Lanka. It is possible that the 'taboo' on beef eating was imposed in Sri Lanka after the spread of Buddhism, as well as by Hindu influence. However, since the fourteenth century, when the Muslim element in the population became substantial, the consumption of beef assumed a new significance. Later, due to the impact of western influences successively under the Portuguese, Dutch and the British, traditional views on beef eating lost their hold on the population and a considerable number of city dwellers and even some villagers have taken upto beef-eating.

Presently large herds of indigenous cattle are being reared for meat in the dry zone and small herds in the wet and intermediate zones. However, in Vanni and Jaffna Peninsula cattle are not sold for meat, due to the influence of the Hindu culture. Here they are considered sacred animals, as in India. Cattle are bought for slaughtering mainly by Muslim traders from the cities and small urban centres. The price of an animal is determined by looking at the animal and by mutual agreement between the seller and the buyer.

As Uragoda has pointed out there had been a traditional small scale cottage industry related to tanning of hides. The main tanning method was to immerse a carefully cleaned skin in an infusion containing tannin and then apply gentle heat to the infusion. In the course of a few hours the tannin penetrated the pores of the skin and converted it into leather.

For tanning hides, extracts from the bark of *kadol* (*Rhizophora mucronate*) plant of *ranavara* (*Cassia auriculata*) and the bark and fruits of cashew (*Anacardium occidentale*) were used. *Kadol* contained the highest concentration of tannin, but it imparted a red discolouration to the leather. [26]

Buffalo and cattle hides and other animal hides have been used for musical instruments such as *gata bera*, *davula*, *tammattama*, *udekki*, *rabana* and *bummeddi*. These hollow wooden musical instruments are covered on one or both sides with hide. Traditional drum making is done mainly in some villages in the Kandy, Nuvaraeliya and Kegalla Districts. Kûragala in Udunuvara and Karagandeniya in Manikhinna are settlements of drum makers in the Kandy district. Weligama in the Nuvaraeliya District is another settlement of drum makers. At Kûragala, there are about 33 families and over 200 workers that produce drums required for schools, temples etc. Karagandeniya consists of about 15 drum making families.

In the south, in the city of Matara, a group of craftsmen have established a society for making drums, even Indian style drums such as *dolaks* and *tablas,* in view of the fact that the traditional art of drum making is dying in the South.

Tradionally, horns, particularly those of the buffalo, have been used for making combs, curios such as birds, handles of small weapons and small boxes to keep items like medicines. The usual tools of the craftsmen who turn out these items include a small adze (1½ inch cutting edge), a coarse rasp, one or two knives, a marking awl, a vice, two or three saws, a file and one or two tools for incising patterns. The combs are made of buffalo horn cut transversely, the tops of the horns being used for knife handles and the like.

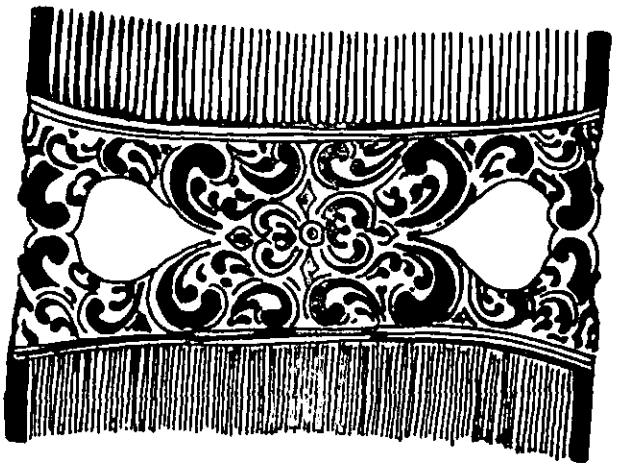

Figure 10: Carved Horned Comb

In making combs, a flat piece of horn is sawn off and cut roughly into the shape of the comb, and then made thinner with adze and rasp. The shaping is then finished with a knife. Thereafter the guidelines for the inner ends of the teeth and for the patterns are scored with the marking awl, which is a small bone tool with a sharp point inserted near one end. The comb is now set in the vice, which is held against a stone by the pressure of the worker's leg.

The vice consists of two pieces of wood tied together near one end and having a vedge inserted at the other, which, when it is driven in, causes the short ends to grip tightly whatever is placed between them. The vice is usually ornamented with a little carving. The teeth of the comb are now cut, first on one side, small teeth with a fine saw, then on the other, coarse teeth with a thicker saw. These teeth are cut very regularly and with back and front to make its edges smooth. Finally the comb is taken out of the vice and a simple pattern incised with a chisel-shaped or with a two or three pointed iron tool. Last of all, the comb is polished by rubbing with wood ashes and horn shavings. [27]

The practice of using cow dung as well as bones as manure had been prevalent in the island from historical times. Utilization of cow dung is widely practised even now in all the regions but intensive use of cow dung as manure can be observed in the Jaffna District and Nuvaraeliya and Welimada areas for purposes of vegetable cultivation.

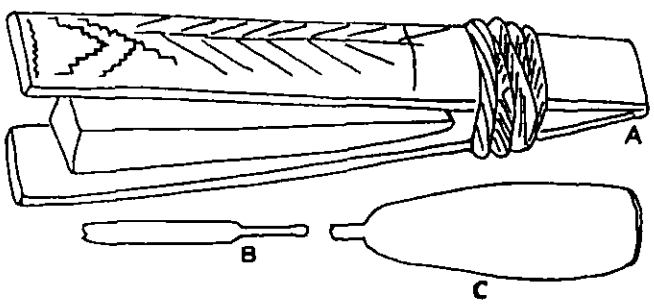

Figure 11: Horn Comb Maker's Tools

Traditional Treatment Methods

The writings of the early Greek and Latin authors contain ample proof of the antiquity of cattle diseases. Ravages of the diseases throughout the various regions of Continental Europe, at irregular intervals, from the fourth to the early part of the eighteenth century, are recorded in sources. In ancient Sri Lanka too, cattle diseases were known and traditional treatment methods prevailed. Besides, systems of preventive care had been developed.

The fifth century A.D. *Papancasudani*, the Pali commentary of Buddhaghosa stipulates that the herdsman should prevent the breeding of insects in the cow-pen, especially during the rainy season. If flies and insects were to be found in the cow-pen, he was expected to cleanse its atmosphere and fumigate the whole area with a view to dispelling the insects. [28]

According to this text when small wounds occur in the animals, due to piercing by thorns and by pointed pieces of wood, flies lay eggs (*asatika*) on them. If these are neglected the wounds get

larger and worms breed in them and, if proper treatment is not given, animals could die of these wounds. When injured cattle come into contact with others in the herd, the disease could spread. The text further states that a sagacious herdsman should remove fly-eggs from small wounds and if the wounds are large they should also be bandaged with the bark of a tree [29]. There would have been barks of medicinal value used for this purpose but the text does not give any clue to the type of the bark in this instance.

Traditional preventive techniques and treatment methods have continued upto the middle of the twentieth century and even now sporadically, herdsmen seek the assistance for treatment from indigenous *vedamahattayas*. But with the availability of veterinarians trained in the western system, traditional veterinary treatment methods are fast disappearing. Indigenous treatment methods of cattle are recorded in treatises such as *Gavaratna*, *Gavavedapota*, *Gavasiddhisâra Chikitsa* and *Satva Aurveda*.

In the treatment system cattle are categorized into breeds (*gothra*) such as *Brahmana*, *Raja*, *Velanda*, *Gowi* and *Upostha*. According to indigenous physicians some of the breeds are more susceptible to diseases. For instance, it is believed that the *Raja* cattle are more vulnerable to a disease known as *adappan* (foot and mouth disease) than others. Thus, the identification of the breed is an important diagnostic tool that relates to the generic resistance of cattle to different diseases.

The diseases are identified by experienced indigenous veterinarians by examining the head, ears, intestines, blood, defecation and urination. In the case of adult cows, the stages of gestation, lactation, number of calvings and age are also taken into consideration.

Medications are prepared by using a combination of various natural ingredients obtained from the eco-system. The commonly employed list of ingredients are tender as well as mature leaves of herbs, barks, flowers, seeds, roots, cannabis-*ganja*- (*Canabis sativum*), ant-hill mud, human urine, animal products such as whey, ghee, eggs, egg shells, bone meal and excreta of bats. The ingredients are usually mixed with essence of ginger (*Zingiber cylindricum*), juice of betel (*Piper betel*), *tippili* (*Piper nigrum*) and lemon, salt water, coconut milk, king coconut (*Eugenia faraica*) water and cold or hot water.

The ingredients required for a particular treatment are either mixed and made into a paste with a roller on a flat granite medicinal stone or crushed into powder in a round granite or wooden container using a pestle. Certain ingredients are just boiled or boiled with milk, ghee or coconut milk.

Medicines are administered to the sick animal through multifaceted treatment regimes. One of the most commonly used is the application of medicinal preparations on particular nerve points known as *nila* as well as on tongue and skin. Medicinal substances are also impregnated through oral routes, nasal routes and rectal/colonic routes.

Medications or smoke are infiltrated to the nasal cavities through a small tube or bamboo. Rectal/ colonic route administration is usually done by using a rolled, ghee-treated tender banana leaf as a funnel. Fumigating the sick animal with ingredients burnt on charcoal, smoke inhalation, warm fermentation with a small bag made of cloth and containing herbs, barks, pods and leaves; tying medicinal powders in places such as the neckline, burning the skin, piercing with a disinfected pointed bamboo or blade and opening up the skin with a sharp object for bleeding are other forms of treatment.[30]

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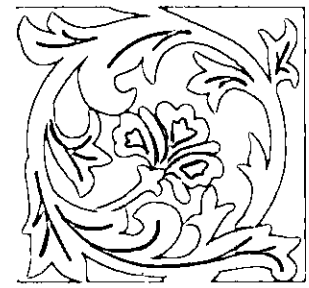

CHAPTER III

IRRIGATION

Introduction

Geographically, Sri Lanka may be divided into three broad regions: a lowland dry zone, a lowland wet zone and a hilly region. The lowland dry zone which covers over two thirds of the land area of the island has a greater extent of land suitable for the cultivation of rice, which is the staple diet of the people, than the wet zone. However, the shortage of water for agriculture constitutes its main problem. Though it receives an annual rainfall of fifty to seventy five inches this is confined mainly to the period of the north-east monsoon (October – April). The land is by no means uniformly flat: numerous rock outcrops and many ranges of hills, several exceeding 1000 feet in height and a few rising to over 2000 feet, stand out from it. The ancient Sri Lankans who took full advantage of differences in contour, created large and small reservoirs by closing gaps between ridges and by damming rivers at higher levels to divert their waters along artificial canals. Thus, they built up a stupendous and intricate irrigation system to which modern engineers have accorded very high praise.

Almost every village in the dry zone, except in the Jaffna Peninsula, had its own village tank which was capable of supplying water for the cultivation of land in the area. The village tanks being small, their construction and upkeep did not demand more labour than the village community could provide. The large reservoirs were used to supply these tanks when rains failed and when there was a scarcity of water, thus ensuring a regular supply of water to immense tracts of land.

Irrigation technology in historical times has been dealt with in some detail by Parker, Brohier, Nicholas and Gunawardena [1]. Particularly important in respect of ancient technology are the large

reservoirs and canals, the construction of which required careful planning and the use of equipment for moving large quantities of earth and huge stone slabs, as well as steel tools which were utilized to work hard granite.

According to Gunawardena, Indian migrations around the middle of the first millennium B.C. probably constituted an important factor in the diffusion of hydraulic technology in proto historic times. The widespread reliance on irrigation reservoir systems and the preponderance of minor scale reservoirs in both South India and Sri Lanka reflect the deep impact of these proto historic contexts. The transition from the initial phase of irrigation activity represented by minor scale reservoirs to the mature phase which saw the appearance of large scale irrigation works took place in Sri Lanka earlier than in South India. [2]

Technological Aspects

In the construction of reservoirs, the gaps along the low ridges running across the plains of the Dry Zone were used efficiently to impound the water flowing through them. Two different techniques were adopted after careful examination of the physiographical and topographical conditions, for impounding water. According to one, an embankment was built using natural rock formations to build a reservoir across a valley where water was available from seasonal streams and rivers. For example, the Kavudulla reservoir has been built by damming the Kavudulu Oya, Hurulu Vava by damming the Yan Oya, Vahalkada tank by damming the Tavalam Halmillava Oya, Kanadara Vava by damming the Kana river, and the Naccaduva tank by damming the Malvatu Oya.

Plate 4: Embankment between two Mountains

According to the other, part of the water flowing down the rivers was turned into excavated canals which conveyed water to more distant lands and reservoirs. The best two examples for this technique are the Giant's Tank or Yoda Vava in the Mannar District and the Parakrama Samudra of the Polonnaruva District. The Giant's Tank built by Dhatusena (455-473) was designed to suit a flat terrain without rocky hills or elevated ground to which the extreme ends of the bunds could

be connected. Therefore the tank bund is 7 miles long and only 14 feet high. The water to the Parakramasamudra was obtained through a canal from a dam constructed at Angamadilla which impounded the water of the Ambangaga. This reservoir had a subsidiary water supply from the north-west through a canal from the Giritale Tank.

Whichever method was used, a large number of reservoirs and canals in an extensive area were connected with each other through an intricate network so that excess water from one invariably flowed into another [3]. The construction of long canals such as the Jaya Ganga which connected the Kala Vava and Tisa Vava and the Alahara which was the main supply source of the Minneri reservoir, required expert knowledge and accurate devices and instruments for levelling and surveying the land to achieve minimum gradient in the flow of water. For instance, the 54 mile long Jaya Ganga has a low gradient of six inches to a mile during the first seventeen miles of its course.

The construction of large reservoirs required the handling of huge stone blocks as well as enormous quantities of earth. Parker has observed that stones weighing upto ten tons were used in some irrigation enterprises of Parakramabahu I (1153-1186) [4]. For the construction of the embankment of the Padaviya reservoir, about 592,500 cubic yards of earth had been brought to the construction site from a considerable distance.

In the anicut built in the middle Anuradhapura Period across the Malvatu Oya, to divert water to the Giant's Tank, and in other similar structures, a cement mixture has been used. Scientific analysis has shown this concrete to have superior properties to the mortar used by the Romans, which had long been accepted as being the best ancient product. [5]

Such constructions, required the use of good stone cutting implements such as trowels, jumpers, chisels and wedges for quarrying and dressing of the stones. The haulage of large stone blocks was possibly done by pulling these along the ground using skids and rollers, with crews of men tugging ropes or by using rough vehicular contrivances drawn by elephants. Bund construction also required a detailed and planned layout for setting height, angle, distance and gradient and such plans were perhaps drawn on perishable material such as ola leaves. Brohier has stated that it was likely that measuring cords and ranging poles or other such simple means had been used for measuring distances in the past. He has further mentioned one recently discovered example of Sinhala cartography of the seventeenth century, which has atrempted to show the irrigation system near Alahara. [6]

While voluntary communal labour was utilized for the construction of small village reservoirs, labour for construction of large reservoirs was obtained through a system of service known as the *vav mehe,* at least from around the ninth century A.D. onwards. Whether *vav mehe* was compulsory or voluntary is not certain. It has to be noted in this context that the earliest reference to *corvee* duty by the term *rajakariya* or *sevakam* is found only in the thirteenth century literary works the *Saddharmaratnavaliya* and the *Pujavaliya.*

The selection of sites for the construction of reservoirs had been carefully decided so that the location prevented the seepage of water into the tank-bed. For example Magalla vava of Mahasena (274-301), located at Nikavaratiya, had been constructed by building a dam across the river at a place where there were granite slabs. The Kavudulla reservoir of the same period has been located at a place where quartz stone layers were abundant.

The choice of sites for the construction of dams has also been carefully planned so that the constructional requirements were minimal. Most of the dams had been located in places where rivers meander and the speed of the flow of water was relatively minimal. For example the Alahara dam had been built in such a place at Ambanganga, a tributary of the Mahaveli. An embankment only about one kilometre in length was necessary to create the gigantic Minneri reservoir which covered an area about 4,670 acres. In fact ancient designers utilized natural rock formations to serve as foundations for their earth works and as a result most of the embankments follow irregular lines. The Hurulu Vava dam constructed by building an embarnkment across the Tavalam Halmillava oya, a tributary of the Yan oya is a good example for this type of construction.

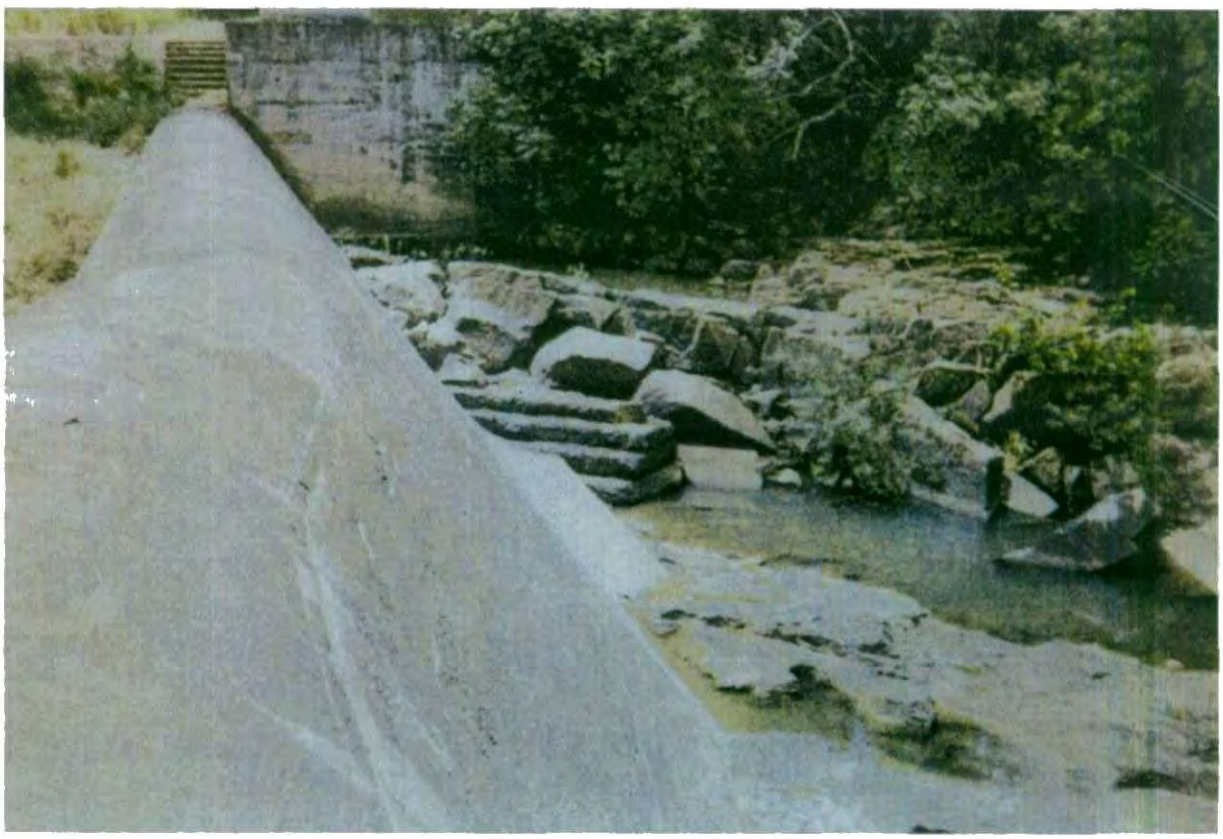

Plate 5: Alahara Dam
(The modern dam is on the left)

Although Red-Brown and wet clay soils were found in abundance in the Dry zone, these soils were avoided in the construction of dams as their water content was high, and the dryness of the bund could not therefore be maintained.

The wave action of large as well as small reservoirs had an erosive effect on the embankment. This effect was counteracted by covering the water face of the earthen embankments with a layer of rough stone boulders. This was and is known by the terms *ralapanava* or *rala pannuma.* It acts as a "wave-breaker" and resists the action of wave play.

Plate 6: *Ralapanawa*

There is a misconception suggesting the use of elephants for hardening the soils in the dam. It has to be noted however that the bunds decreased in size from bottom up, and could therefore only be trampled down by the elephants at the level of the foundation. As the bunds rose in height, herds of goats and cattle were driven over them and the soils hardened with their hooves. The modern adaptation of this method is called the "sheep's foot roller". In this machine, a roller studded with an imitation of a sheep's foot, is run up and down the embankment in tandem with a tractor. The cylinder of the roller is filled with sand to produce a light pressure, as was used in the ancient method. [6]

Some of the bunds, except for their topmost surfaces, were built only with stone. For example, the outer wall of the Sukharanijjhara dam on the Daduru Oya, presently identified as the Ridibandi Ala dam, constructed by Parakramabahu I (1153-1186) was built with well cut stone blocks which are so intricately fitted that the joints are only a quarter of an inch wide. Its inner core was formed of undressed rubble laid in lime concrete.[7]

Waste-weir (Pali: *avarana* or Sinhala: *vana*) was an essential element of the embankment, for the safety of the reservoir. The waste-weir released excess water during heavy rains and when reservoirs were full. This enabled high water pressures to be controlled, so that the embankments could be kept intact. Larger reservoirs were provided with more than one waste–weir, whereas small reservoirs had only one waste-weir.

These spillways were either made of stone blocks or located on natural rocks on the bund. During heavy rains and floods, excess water from the tank passed over the spillways. For instance, the spillway of the Kala Vava is a natural granite rock chiseled by stone masons. This spillway is in its original position and stands out even today as a stupendous construction. The later restorations have left the old spillway untouched.

Plate 7: Spillway at Kalavava

In the rudimentary small village reservoirs, bailing devices or stone walled canals leading through openings in the bunds were used for discharging water. Later cylindrical, burnt-clay pipes were laid under the bund. But such systems were totally inadequate to release water from large reservoirs. The release of water had to be controlled without any damage to the embankment.

Therefore, at least from the early centuries of the Christian era, the outward flow of large reservoirs into canals had been regulated through intricately designed sluices. These sluices consisted of four essential parts. They were (a) a rectangular or square well or pit (*bisokotuva*) from a spot near the crest of the dam,dug down to a certain depth, (b) an apparatus fitted to the *bisokotuva,* by rasing or lowering of which the flow of discharging water could be controlled; (c) an inlet culvert or two culverts through which water passed into the well; (d) a discharging culvert or two culverts from the well to the outer slope of the bank.

Although all sluices are known in popular parlance as *bisokotuvas (Queen's enclosure)*; it is only the rectangular or square well that could correctly be called a *bisokotuva,* as the complete sluice had three other components. The walls of the well were formed of large stones, some of which were twelve feet by four, fitted closely to each other. These were fitted in such a manner that there was no seepage of water from the walls, a feature that has lasted several centuries.The apparatus fitted to the *bisokotuva* took the form of either a piston or a cistern. As Gunawardena has pointed out, the piston type of sluice was more common in South India than in Sri Lanka. In fact, examples of piston sluices have not been found in the island. However, there are a few literary references and one inscriptional reference to the piston used in sluices in Sri Lanka. The fifth century A.D. Pali commentary, the *Samantapasadika* refers to this apparatus as *udaka niddhamana tumbha*[8] (water releasing cistern). *The Jataka Atuva Gatapadaya* written in the late Anuradhapura or the Polonnaruva

era refers to this type of piston as *raja mohol*[9] or 'royal pestle'. The *Pujavaliya* written in the thirteenth century also contains a reference to the same apparatus [10]. The Vessagiri inscription of Mahinda IV (956-972) contains the phrase "*mohol nanga diya pana kot*" meaning "releasing water by raising the piston." [11]

However, in Sri Lanka the piston sluices do not seem to have been popular because they have had a lower water handling capacity. They did not release large quantities of water at high pressure but minimized the damage to the embankment. [12]

The more popular cistern type sluices have been observed in Sri Lanka in many reservoirs including the Kantalay, Minneri, Kavudulu, Vahalkada, Pavatkulam, Urusitavava, Naccaduva, Nuvaravava and Parakrama Samudra. A good example of these is a cistern found at the sluice at Vahalkada, as reported by Gunawardena.

This cistern which is situated on the inner face of the embankment measures 12 feet along the line of the embankment and is 8 feet wide. It is built of regularly cut dressed blocks of stone, backed with brick work and rises to a height of 8 feet. From this point upwards the walls of the cistern are built of brick and have no stone facing. The upper part of the structure has collapsed, and at present, the total height of the cistern is about 9 feet 10 inches. The cistern is connected to the reservoir by two inlets of stone work each of which is two feet wide, four feet high and seventeen feet long. [13]

Gunawardena also has made some general observations on the main features of the cisterns in the sluices, on the basis of information from structures at Vahalkada and other reservoirs. The cistern, according to these observations was placed within the embankment of the reservoir, on its inner face. It was either square or rectangular in plan. The inner face of the cistern is generally lined with dressed, stone slabs which are neatly fitted together. They cover masonry work built of brick, laid in clay or lime mortar, and vary from three to seven feet in thickness. At the cistern of the sluice of the Naccaduva reservoir, the wall traversed by its inlets was built to a thickness of 11 feet. In many cases, the stone facing did not cover the whole height of the cistern. At the Naccaduva reservoir, it extended only upto a height of 3 feet while the cistern of the high level sluice of the Nuwaravava reservoir was built entirely of brick and had no lining of stone.

Of the variety of plan measurements of cisterns recorded at the more important reservoirs, the smaller ones are about 8 feet square and 8 feet 4 inches by 7 feet 10 inches, while at the upper end of the scale are those that measure 11 by 15 feet and 12 by 14 feet. When a cistern is rectangular in plan, it is the sides parallel to the embankment which are found to be the longest. [14]

The inlet channels which connect the cistern with the reservoir were, as a rule, of the same level as the floor of the cistern. At the sluices of the Sangilikanadara vava, Urusitavava, and Kantalay vava the cistern had only one inlet channel. But reservoirs such as Vahalkada were provided with two inlet channels. In certain instances, the inlet channel bifurcates into smaller conduits just before entering the cistern. For instance, at the high level sluice of the Nuvaravava, the inlet channel which was 2 feet 9 inches high and 2 feet 6 inches wide extended upto a distance of 25 feet from the cistern before dividing into two channels. Generally inlets of most of the sluices are short channels which extend only upto the water face of the reservoir or slightly beyond it.

Plate 8: *Bisokotuva* at the ancient Buvava near Parakrama Samudra and inlet Culvert of the *Bisokotuva*

In general, outlet channels are longer than the inlets as they have to traverse the greater part of the width of the embankment to discharge the water into irrigation channels. In most reservoirs, there were two conduits to lead the water out of the cistern. But the sluice of the Sangilikanadara reservoir had only one outlet. At most sluices the outlet channels are, like the inlets, at level with the sill of the cistern but at some reservoirs they are placed at a higher level.

Thus the sluices of large reservoirs have been categorized by Gunawardena into three groups in accordance with the arrangement of inlet and outlet channels: (i) those with one inlet and one outlet; (ii) those with two inlets and two outlets; (iii) those with one inlet and two outlets. (15)

In some of the large reservoirs, there was only one sluice as at Minneri and Kavudulu, but the larger ancient reservoirs usually had at least two sluices, as at Kantalay, Vahalkada and Nuvaravava. At the Pavatkulam reservoir, there were five sluices. The higher level sluice or sluices were used when the water level of the reservoir was increased and the lower level sluice or sluices were used only after the water level had fallen considerably. (16)

The construction of dams and intricate sluices by the ancient Sri Lankans has evoked admiration by Western engineers such as Henrey Parker, an irrigation engineer who worked in Sri Lanka from 1873 to 1904. He was impressed by the engineering knowledge of the designers of great irrigation schemes of Sri Lanka and the skill which was used in the construction of the schemes. (17)

Recently when the Sri Lankan authorities built a reservoir at Maduru Oya, the remains of an ancient dam at the same site selected for the new bund was discovered. Furthermore, an old sluice was unearthed at the exact spot where the new sluice to be constructed was located.[18] The same could be said regarding many of the ancient dams and sluices, because recent restorations have not completely ignored their locations.

The interconnection of large, medium and small reservoirs was achieved through an intricate system of canals and branch canals. For example, the 54 mile long canal constructed from the Kalavava augmented the water supply of the Tissavava at Anuradhapura and a branch channel from the main canal increased the waters of the Kanadaravava. Further, the smaller canals from such main or branch canals either diverted water directly into paddy fields on the way or filled storage tanks

or even subsidiary tanks. In most of the canals, it appears as if water flows on a flat terrain, but an imperceptible gradient achieved through sophisticated methods of leveling could be observed in almost all of them. An irrigation engineer J.A. Balfour who worked in the Dry Zone in the early years of the twentieth century has observed that the art of aligning such channels was well developed. In one case a modern branch channel set out some time before 1914, was found to run along the same line as an ancient branch constructed to irrigate the same lands, the old and the new channel never being more than a few feet away from one another. Balfour in fact, has stated that "we frequently found ourselves anticipated by our ancient predecessors." [19]

Distribution of Water

From very ancient times, there were well organized systems of distribution of water and irrigation management. Even during periods of scarcity the system ensured an equal share for all cultivators. The farmer's share of water was called *diyamura*, [20] and for this share he had to pay a stipulated amount to the king, the local authority, or the individual tank owner, in accordance with his supply. In the early Anuradhapura period, this payment was called *dakapati* and in the late Anuradhapura period *diyabedum*. In the Polonnaruva era, the water rates were termed *diyadada*. When water in the reservoirs was reduced during times of drought, distribution was done in rotation. The community ensured such limited distribution equitably and obtaining water out of turn was considered a theft. [21]

To check malpractices, there were officials to supervise the distribution of water and the irrigation works. The term *piyovadaranan* found in the ninth and tenth century inscriptions may be interpreted as "supervisors of irrigation works" or "supervisors of the supply of water". Two other terms *Velayut Pasdena* and *Velayut Samdaruvan* found in inscriptions belonging almost to the same period may mean "five superintendents of fields" who were also entrusted with the distribution of water in the late Anuradhapura period. [22]

Thus local communities enjoyed a high degree of autonomy in the development as well as management of small hydraulic works. Therefore, resource management experience was widespread in society. Irrespective of the weakening of the ancient Sinhala kingdom and the collapse of the major irrigation works after the middle of the thirteenth century, the accumulated knowledge in the management system of irrigation survived at least to some extent. The main reason for this survival was the fact that the Dry Zone village was not simply a conglomeration of peoples but was a bonded community which co-ordinated the scarce resources for existence. The time tested rules and institutions helped this co-ordination of resources.

As in the past, even in the twentieth century, in the Dry Zone, during periods of water shortage, distribution of water was done under a roster system called *Mura vatura*. In this system, the farmers at the tail end of the irrigation channel received water first and the roster moved up gradually towards the paddy fields near the bund of the tank. During times of scarcity of water, every farmer in a Dry Zone village had a share called *panguva* in advantageous and disadvantageous locations (*Ihalabage*, *Medabage* and *Pahalabage*) so that all in the village received an equitable supply of water. This was called the *bethma* arrangement. The *Gamarala* and the *Velvidane* ensured the proper functioning of these operations. This resource use system was sustainable and provided a high degree of stability to the local economies before modern socio-economic changes took place. [23]

All village labour was also performed by *pangu*. For instance, in a particular village, if there were forty *pangus*, the bund of the village reservoir was also divided by custom into forty parts so that every *pangu* holder knew the portion for which he was responsible. The irrigation channel which released water was also divided into forty parts and so was the village road. If the *panguva* was subdivided each sub division performed a proportionate part of all the labour due for the *panguva*. The *Gamsabhava* or the village council ensured the proper functioning of the system.

Water Management Practices in Jaffna

Even though the Jaffna Peninsula belongs to the dry zone; it emerges as a separate region from the rest of the dry zone, and its structure is different from those of other dry zone regions. Its land is underlain with blocks of porous limestone with supplies of underground water. Owing to the absence of mountains, there aren't natural rivers and streams in the Peninsula. It experiences one main monsoon season; the North-East monsoon and even during this period the rainfall is restricted to only three months from October to December. There is little or no rainfall during the South-West monsoon. In most instances, water for domestic and agricultural purposes have to be obtained through well irrigation. In fact lift irrigation has been the mainstay of subsistence farming in Jaffna.

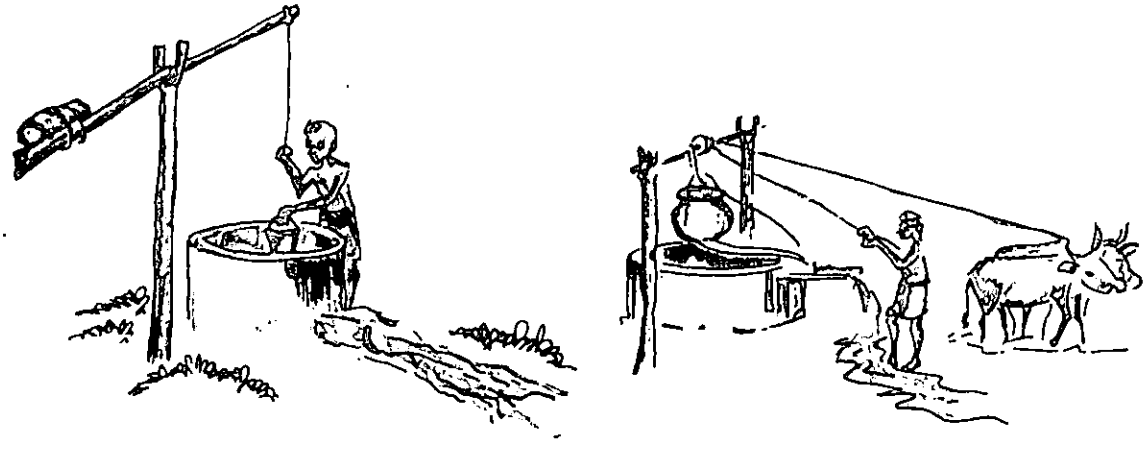

Figure 12: Water lifting Devices in Jaffna

There have been at least two traditional types of contrivances used in lifting water from wells. One type was operated by bullocks and the other by humans. The contrivance made to lift water in both cases was mostly made of palmyrah (*Borassus flabelliforms*).

Palmyrah is chipped by craftsmen into the shape of a massive spindle. Usually two halves of a palmyrah trunk are joined together to give girth. At the falcrum a cross bar (Tamil: *Atchulakai*) of a strong wood is driven into it. Almost the full length of the sweep is slightly flattened so that two or three people could walk on it. Side pegs are driven to give a ladder effect to enable the walking men to hold it if they require.

In the vicinity of the well, six or eight trees planted in two rows at a distance of about 3 metres carry the weight of the sweep. These trees are tied to three rows of horizontal timber on either side to give more strength and hold them in position. The sweep is then raised by men by a makeshift pulley to rest the cross bar on the middle horizontal cross-timber.

Depending on the volume of water to be raised, from one upto three men walk to and fro on the sweep. When the men walk towards the thin end, the sweep will dip into the mouth of the well. A man standing at the mouth of the well will guide the rope into the well. The rope is made of fibre taken off the palmyrah stem (Tamil: *naar*) and is strong and ideally suited for the purpose. The bucket (Tamil: *pattai*) is made of woven palmyrah leaves in an octagonal shape and can hold eight to ten gallons of water at a time. The bucket is reinforced by leather to prevent it from leaking. When the men on the sweep walk back to its broad end, the sweep comes up and the man at the mouth of the well tips the water into a trough, from which it flows down to the area that needs to be watered. Thus the water that runs along small man-made channels is directed from plant bed to plant bed. This process is called *thani maathal* in Tamil and is labour intensive. In order to avoid harsh sun, the farmers who operate these contrivances start work around 3.00 am or 4.00 am and complete the work by 9.00 am. The system is environmentally friendly and is in total harmony with the ecological cycle. [24]

Another form of the well sweep in Jaffna is operated by a single man. A low beam is fixed to a pole which is weighted down at one end. To the other end a bucket is tied. The water could be lifted by raising and lowering the pole.

The bullock drawn system could lift water in a large vessel the capacity of which is around 20 gallons. A man lowers the specially made beam into the well with the help of a rope or chain fixed on to a wheel. The vessel is tied to the end of the rope or the chain. When the vessel is filled with water it is drawn up by two bulls in harness. A long wide tube of rubber or hide is attached to the vessel. When the vessel comes to the top, water is filled into a nearby trough and directed to the plant beds through small canals. [25]

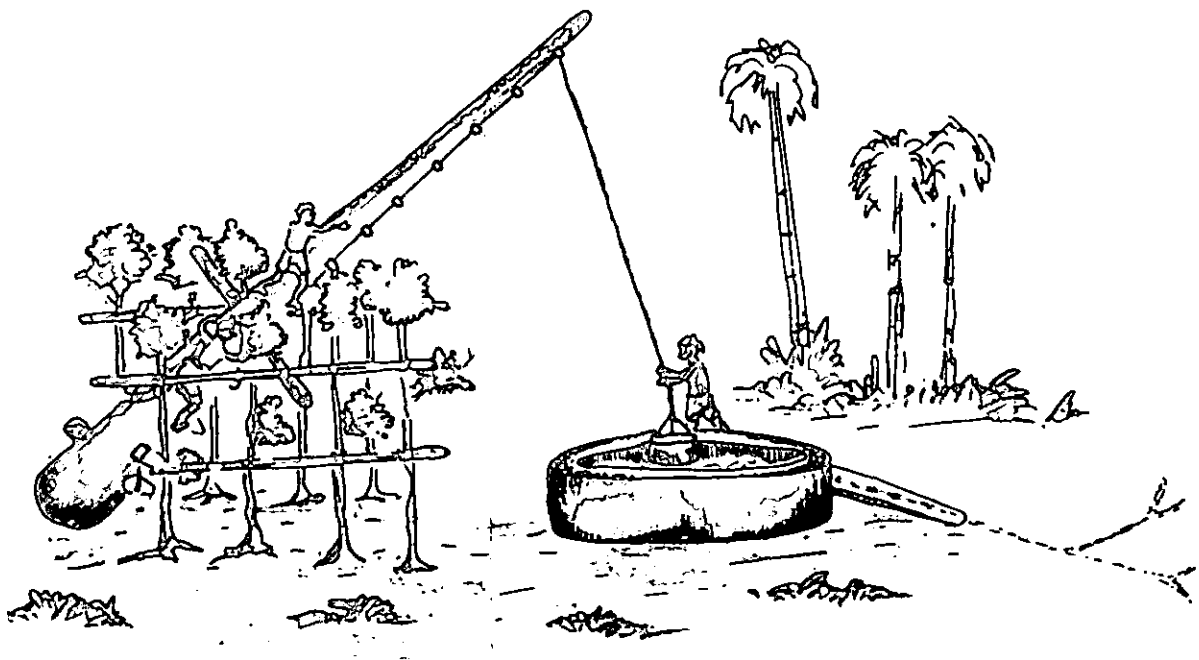

Figure 13: Well- Sweep in Jaffna

Even outside the Jaffna Peninsula wells have long been used for storage for domestic consumption. The archaeological remains of wells in monastic complexes indicate the wide use of wells in human habitations. These wells had been lined with brick, rubble or dressed granite to ensure a supply of clean water.

Ritual Practices

Among many rituals performed by the peasants in the Dry Zone reservoir based regions, three related to irrigation and agriculture deserve special attention. They are a) *kiri itirima* or boiling of milk, b) *mutti mangalyaya* or pot ceremony and c) *hunnakada vedilla* or ritual firing.

The ceremony of boiling milk *kiri itirima* is performed after each harvest on a morning of a Wednesday or Saturday which are considered to be the *kemmura* days and best suited to appease deities. The objective is the protection and well-being of reservoirs, crops, cattle etc. The five deities whose blessings are invoked are *Aiyanayake, Kambili, Ilandari, Puduressa* and *Kadugath Bandara.* Every family in the village contributes rice for *kiribath* and some families contribute milk as well. The ritual is performed under a lactiferous tree near paddy fields or the reservoir. A thatched shed is temporarily built in the venue and its roof is covered with a white cloth. The milk rice is cooked inside this shed in a large pot called *raja häliya.* Another small hut *mal päla* is constructed nearby to place the accoutrements of deities obtained from the village temple. While food is cooked the ceremonially attired *kapurâla* – the main actor in rituals-prays and appeals to deities amidst drumming. Once the milk rice is cooked, it is offered to deities first, along with other offerings such as betel leaves (*Piper betel)* and thereafter the villagers consume *kiribath* and disperse.

The most important ritual performed specially in Rajarata is called the *mutti mangalyaya,* or the *mutti perehara* or the *mutti namima.* They are so called because the most important utensil in the ritual is the pot (*muttiya*). The ceremony is performed to invoke the blessings of guardian deities to protect the reservoir and the cultivations. The guardian deties whose blessings are invoked are *Aiyanayake* and several other gods, the numher of which varies from region to region.

In the past these rituals would have been performed regularly, but at present they are conducted once in three, five or seven years. Three respected village elders decide on the dates on which to perform these ceremonies. When the reserervoir is full these three village elders accompanied by several others proceed to the venue of the *mutti mangalyaya* with their votive offerings. They then take a vow by tying a *pandura*-coin washed in water mixed with turmeric and wrapped in a piece of cloth on to a branch of the tree on which pots will be placed, promising that the ceremony will be performed after the harvest.

The ceremony is conducted usually on a Wednesday or Saturday which days are considered to be the *kemmura* days or days best suitable to appease gods. Prior to the performance of the *Mutti Mangalyaya*, three village elders approach the *kapuva* or the person who performs the rituals in the village temple, the drummer and the washerman and invite them to render their services at the ceremony. A village elder, formally known as *vel vidane,* visits the village potter as well and requests him to make the pots for the ceremony. When the potter agrees, he is then bound to refrain from partaking of meat or fish, while he is engaged in making these ceremonial pots.

On the day prior to the ceremony a special thatched hut is constructed in front of the *vel vidane's* house and villagers bring and place items such as sugarcane, juggery, fruits, rice and coconut in the

hut. The contribution depends on the extent of land owned by each villager. In the evening, the potter brings the pots made by him, covered with a white cloth. The *kapurala,* who is present at *vel vidane's* house by this time, receives them and keeps them in a specially designated place in the hut. The final ritual is performed by the tank bund, in shallow waters, by a tree which has forked branches, on which the pots could be placed. When such a tree cannot be found, a forked branch of a lactiferous tree is erected instead. A small thatched hut is also constructed alongside the reservoir bund.

Later in the evening the villagers led by *kapurala* proceed to the venue of the *Mutti Mangalyaya* in a procession and place the accoutrements of the deities and several food items including juggery and fruits along with betel in a rack (*mässa*) in the thatched hut. Thereafter, for about two hours in the night chanting verses and praying to the gods amidst sounds of drums takes place. Then everyone returns to *vel vidane's* house and partakes of the meal prepared by womenfolk towards which all villagers had contributed earlier. The meal will not include any items fried in oil.

Early in the morning three earthern pots are filled with buffalo milk and then covered with white cloth. The pots are then taken in procession to the venue of the ceremony. Here, amidst recitations praising the god *Aiyanayake* the *Kapurala* accepts the pots to the accompaniment of drums, and places them in the rack of the thatched hut. He continues to pray to gods for protection of the reservoir, for a plentiful harvest, for the villagers and their cattle. In the meantime rice is boiled in a large pot at an improvised hearth and milk brought by village elders is poured into it. Once the milk overflows and the *kiribath* or milk rice is ready a coconut is broken. In certain areas a gun shot is also fired.

Having set apart some of the milk rice as an offering to the gods, the three village elders proceed to the *mutti namana gaha* or the tree where the final ritual is performed, the pots are upturned and the milk poured into the water in the reservoir. Then three gunshots are fired. The ceremony ends with all assembled partaking of milk rice on the reservoir bund.

This is the general form of *mutti mangalyaya* but there are minor variations from region to region. In the major reservoirs such as the Kalavava, Huruluvava, Nuvaravava, Padaviya vava, Mahakanadarava vava, Mahavilacchiya vava and the Minneri vava, the ritual is organized by the government officers and the ceremony is patronized by the local political leadership. The *Mutti Perahara* or procession is conducted on a grand scale. Besides, in certain reservoirs, pride of place among deities is afforded to deities who are supposed to have protected the reservoirs throughout history. For instance, at Minneriya, the chief deity whose blessings are invoked is god *Minneri*, at Kalavava god *Kadavara* and at Padaviya god *Padavi*. In such instances god *Aiyanayake* plays a secondary role.

The third important ritual related to reservoirs is called "*Hunnakada Mangalyaya*" or the 'ritual gunshot.' It is performed when the village reservoir is full and about to spill. The objective of the ritual is to safeguard the reservoir bund from breaching. The village elders reach the bund and pray to god *Aiyanayake* to prevent it breaching. Thereafter three gunshots called "ritual shots" are fired. [26]

These rituals indicate the system of participatory water management of the Dry Zone peasantry. They are related to the belief in super natural powers but they also indicate the solidarity among village communities for upkeep of the village reservoirs and paddy fields, around which the life of the villagers revolved. The participation and contribution of all status groups such as the cultivators, drummers, washermen in the ceremonial festivals and partaking of food together during or at the end of rituals, symbolize a strong bond among residents of a village and illustrates a collective

responsibility. The rituals also help to maintain close relationships between the community and the reservoir, paddy fields and the whole agro-ecological system.

The importance of the Kumbuk Tree

In this context the traditional knowledge of the *Kumbuk* tree as a water preserver and purifier deserves attention. The *Kumbuk* tree is found growing by the sides of several anicuts, canals, wells etc. mostly in the dry zone and partially in the wet zone as well.

Kumbuk in fact is a water softner as well as a clarifying agent. Ground water in the dry zone is hard due to the presence of calcium salts and to a lesser extent, magnesium bicarbonates and sulphates. The roots of the *Kumbuk* absorb the calcium and soften the water. The bark of the *Kumbuk* tree is about an inch in thickness and could be stripped in large pieces. These pieces at the bottom of a well serve the purpose of purifying the water. [27]

It is possible that the efficacy of the *Kumbuk* tree in regard to the softening of water was known in the traditional knowledge system of ancient Sri Lanka, and accordingly the trees were planted for that purpose.

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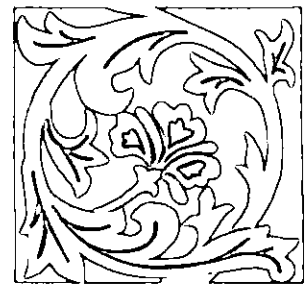


CHAPTER IV

MARINE FISHERIES

Historical Background

Direct evidence on marine fishing in Sri Lanka prior to the sixteenth century A.D. is limited. This may be due to the fact that it was not important as an economic activity. The concentration of population in the interior of the Dry Zone upto the thirteenth century, and the difficulty of transporting sea-fish to these regions due to the rudimentary nature of communication facilities, were reasons why marine fishing was not widely practised.

Nevertheless, sporadic references indicate that the vast wealth of the seas surrounding the island had been exploited from pre-Christian times. The Dutthagamani legend in the chronicles and literature in describing the pregnancy cravings of Viharamahadevi refers to an overturned boat in the sea coast. The same story in describing the construction of the Mahathupa refers to fishermen at Uruvela Pattana or the port of Uruvela [1] at the mouth of Kala Oya. The fifth century Pali commentary *Papancasudani* refers to a fisherman who lived at Kalyani (Modern Mutval) at the mouth of the Kelani river [2]. Some of the Pali texts of the Anuradhapura period and the Sinhala literary works of the thirteenth, fourteenth and fifteenth centuries refer to fishing villages (*Kevattagama* in Pali and *Kevulgama* in Sinhala) in the littoral. The Roman and Greek writers, Pliny of the first century A.D. and Aelian who lived between 170 and 235 A.D. refer to fishing in the seas of Taprobane. Aelian in fact mentions two varieties of dolphins in the seas around Taprobane and states that the varieties with sharp pointed teeth were dreaded by fishermen. [3]

Presumably, different kinds of vessels were used in sea fishing. Many classical Sinhala texts written between the ninth century and the fifteenth century refer to canoes made of a single block of wood (*ek dandu oru*), double canoes (*anguL*), rafts (*paharu* or *páru*) and ships (*näv*) [4]. The construction of these vessels presupposes the availability of tools and implements such as the axe (*porova*), adze (*väya*), borer (*katuva*), chisel (*niyana*), hammer (*mitiya*), needle (*vidina katuva*) and the saw (*kiyata*). Almost all of these are mentioned in the post ninth century Sinhala literature. When tying and binding were necessary in the construction of vessels, strings and ropes made of coconut fibre has been utilized. [5]

Although sea fishing for internal consumption has been limited, some of the marine products of ancient Sri Lanka had a ready demand in foreign countries. The tortoise shells of Sri Lanka were important exports of the island which were cherished particularly in the Graeco-Roman world from around the third century B.C. to the sixth century A.D. Pliny, Aelian and the author of the *Periplus of the Erythrean Sea* refer to tortoise shells of Taprobane indicating that turtles were exploited in the island during this period. [6]

From the very beginning of recorded history, Pali and Sinhala chronicles and literary texts refer to conchs, horn shells, chanks and cowries found in the sea coast of the island. There had been a commercial demand for these items in foreign countries, while some conchs were domestically used as musical instruments at certain rituals and ceremonies. Pliny refers to valuable corals in the Indian Ocean while the ninth century Arab seafarer Suleiman, the first Arab writer to refer to the Sri Pada mountain as the Adam's Peak, has written on various chanks and conchs found in the sea coast of Serandib. [7]

Pearls were the most valuable aquatic resource in Sri Lanka and were exploited from pre-Christian times. Megasthenes; the Greek ambassador to the Mauryan royal court in India in the fourth century B.C; the Roman writers Pliny and Solinus Polyhistor as well as the author of the *Periplus of the Erythrian Sea*, the Chinese travellers Fa-Hsien and Hieun-Tsang; Suleiman, the ninth century Arab geographer; Al-Beruni, the Persian historian who served in the court of Sultan Ghazni Mahmud of Delhi in the eleventh century; the twelfth century Arab traveller Al Idrisi; the thirteenth century Arab geographer Kazwini and the historian Al-Maqrisi; the fourteenth century Bishop Jordanus as well as the Italian Friar Odoric; Wang-Ta-Yuan, the Chinese merchant who travelled overseas in the fourteenth century; the famous Arab traveller Ibn Batuta who arrived in Serandib in 1344; the fifteenth century Chinese travellers Mahuan and Fe-hsin have all alike emphasized the importance of the pearl banks and pearl fisheries in Sri Lanka. [8]

Some of them, such as Megasthenes, Polyhistor and Fa-Hsien, state that the pearls found in the island of Taprobane were large. According to Fa-Hsien, there were extremely valuable gems and pearls deposited in the monastic store-houses at Anuradhapura. Hieun-Tsang as well as Wang-Ta-Yuan referred to the rituals performed by the king just before the pearl fisheries began. Polyhistor states that the value of pearls depended on feeding patterns of the oysters. Fa-Hsien records that three out of every five pearls belonged to the king while Hieun-Tsang mentions that a share of the pearls was taken by the king as tax. According to Wang-Ta-Yuan three out of every ten pearls were given to the king. These discrepancies indicate the fact that the king's share was not static and uniform and that it varied from time to time. Ibn Batuta stated that the king of Jaffna or Aryacakravarti possessed many valuable pearls and that when he visited the court of Jaffna he saw the king's employees sorting out pearls. [9]

Bishop Jordanus has written on pearl fisheries conducted in the sea between India and Sri Lanka, (most probably off Mannar), for which about 8000 crafts were utilized. Wang-Ta-Yuan too provides a graphic description of the pearl fisheries and pearl divers off the coast of Sri Lanka. [10]

The Portuguese chronicles and documents of the sixteenth and seventeenth centuries have also preserved evidence on pearl fishing off the coast of Mannar. As C.R. de Silva has pointed out, they enable us to obtain some idea of the size and importance of the industry, the methods of fishing employed and the impact of the pearl fishery on the religious and political developments of the littoral. During that era, the best known and the largest of the pearl banks were located off Hainan

in the South China Sea, off the island of Bahrein in the Persian Gulf and in the Gulf of Mannar. The pearl beds off South India and Sri Lanka constituted one of the two major sources of pearls in the world, rivalled in size only by that of Hainan. The pearls fished from the Gulf of Mannar were also considered among the best in the world and fetched a high price in Europe. [11]

During the Portuguese period a large number of persons including divers, merchants and others were engaged in the pearl fishery at Mannar, whenever it was held. The decision whether or not to hold the fishing was taken on the basis of a pilot survey carried out in the previous year. In the month before the actual harvesting took place, a series of temporary buildings were constructed on the sea shore near the oyster beds. These buildings served as store houses, shops and dwellings. The captain of Mannar, who supervised the construction, allotted different areas to different castes. Then the vessels and divers who were to participate in the fishery were registered. The number of such vessels varied between two hundred and four hundred, with a maximum of eight divers to a boat. [12]

The exploitation of the pearl fisheries continued during the Dutch and the British colonial rule. In the early decades of British rule, from March 1828 to May 1837, sterling pounds 227,131 were credited as revenue into the Ceylon Treasury on account of the pearl fisheries[13]. The Pearl fisheries had been an important source of revenue until the middle decades of the twentieth century. In view of the magnitude of the operation, pearl fisheries operated throughout the centuries with state intervention. After the mid-twentieth century major scale pearl fisheries had not been conducted due to many factors which need to be examined in detail by researchers in socio-economics. A generally accepted reason is the heavy overhead expenditure involved in large scale pearl fisheries. Here, the attention is focused mainly on the traditional forms of pearling.

The breeding grounds of the pearl oysters are the rocky banks of the sea, 16 to 18 kilometres away from the shore in the District of Mannar, off Jaffna, Balapitiya, Chilaw, off Tambalagama and Negambo. But those worthy of exploitation were found mostly off the coast of Mannar, although other sites also have been exploited for the pearls they contain, particularly those off the Tambalagam lagoon on the east coast. The pearls obtained from these sites were however found to be of lesser value and were smaller than the former.

The life span of oysters is about six years and thereafter they decay and die. Therefore pearl fisheries could be conducted only at irregular intervals; at most once in five or six years. When the oysters mature completely their byssus begin to break and they fall into the sandy bottom of the sea from the rocky banks they inhabit.

All oysters do not contain pearls and perhaps chemical reactions in the body and the type of food they consume help some oysters to produce pearls. Those productive ones contain one or many pearls, sometimes as many as sixty, and they are found in all parts of the flesh of the oyster. The pearls are also of various shades and colours but the most valuable ones are the silvery white ones.

Before the fishing commenced, many temporary buildings were constructed by the shore to accommodate troops, watchmen, customs officers, divers, boatmen, labourers etc. and also as store houses or enclosures for oysters. The boats or canoes filled with people were also brought in a month or six weeks previous to the commencement of fishery. Various kinds of merchandise for sale to the inhabitants in the surrounding areas as well as for utilization of those involved in the fishery were also brought in by petty traders.

Once a date was fixed for the boats to go out to sea for fishing, the fishermen were expected to be ready to start about mid-night on that day. At a given signal a government guard vessel, which carried a larger light than the lights of canoes of fishermen, was steered out and the other vessels followed it. Each vessel consisted of its owner, ten divers, ten rowers who attended the divers and a government representative.

Every vessel was also furnished with five conical stones each weighing 10 to 12 kilograms and tied to a coir cord, sufficiently long to reach the bottom of the sea. These stones were to assist the divers in their descent. Each vessel was provided with five baskets made of coir or yarn ropes. The two sides of the baskets were laced to iron hoops which were slung and suspended on coir cords. The baskets were used by the divers for collecting the oysters.

After reaching the area of the rocky banks where the pearls were to be fished, the vessels were anchored. At sunrise, once a signal was given, the fishing commenced. Scantily clad divers, after a slight moment of meditative ritual, began the descent. Five from each vessel plunged into the sea and swam to their respective sinking stones, which had already been lowered from the sides of the vessels by respective attendants.

Each diving stone was suspended by a double cord and the basket by a single rope. On reaching the bottom each diver abandoned the stone and filled the basket with oysters. On a single occasion a diver could remain under water only for 55 to 75 seconds. When he wished to ascend, he jerked the cord of the basket and the respective attendants on board pulled the rope up. The diver also climbed up by holding the same rope and the basket. On reaching the surface he abandoned the cord and quickly swam to his sinking stone which has been hauled up earlier. Meanwhile the basket of oysters was emptied into the vessel by the attendants. When the divers were rested and ready, they went down to the bottom once more.

This process of fishing was repeated by five divers in each vessel until they were relieved by the other five to allow resting period for the former. Thus diving was done by two groups alternately. When the day's work ceased, all vessels moved off from the fishing ground and reached the coast. The oysters were then conveyed by supervised labourers to special enclosures.The fishery continued in this manner into the month of April.

The oysters were usually washed and then separated .For this purpose, they were put in canoes and sea water was poured onto them. After washing, the oysters which were presumed to contain pearls were set apart to be opened. Those which had no pearls were thrown in heaps outside the enclosures. The pearls were separated from the washed oysters and were spread on cloth and exposed to the sun to dry.[14]

Not only pearl fisheries but also other forms of marine fishing had become more and more important in the economy from the sixteenth century onwards. After the decline and abandonment of the interior of the Dry Zone, the population in the Wet Zone as well as the population in the coastal belt increased. Besides, with the arrival of the European sea powers from the sixteenth century onwards, the demand for sea fish increased and the dietary habits of the local inhabitants also began to change. There had also been an increased demand for conchs, horn shells, chanks, cowries and pearls in the European market.

In this period, which covered more than three centuries, sea fisheries had become very important. During their direct rule of the maritime provinces, the Portuguese (1597-1656/58) exacted from each fishing vessel a tax called *Oru Panam* and a tax on nets called *dal panam*. The Dutch also collected dues from the fisheries, fishing vessels and nets [15]. Later on, during the early decades of the British Colonial rule, the Colebrooke Commission recommended a monthly license scheme for fishing crafts.

Fishing Locations and Crafts

In all forms of marine fisheries, traditional techniques have continued through centuries, without much change. From the mid 1950's mechanized methods had been introduced but in most instances traditional techniques took pride of place. For instance, in 2000 A.D. the number of traditional crafts used in fishing was 15109 as against mechanized crafts which numbered 11590. In 1972, there were 969 fishing villages in the entire coastal region of the island. This number had risen to 1437 by 1999. The number of coastal fishing households in 1972 was 58298 and it had increased to 98,157 by 1999. The total population of fishing households in 1972 was 244,642 and by 1999 it had increased to 441,707.[16]

Although traditional techniques of fishing are still predominant, some of the techniques and practices used through time immemorial, have already died out or are fast dying out. For instance, in the traditional system, social groups in fishing villages such as Mirissa closer to Matara were formed according to the variety of fish exploited, equipment used and the location of the fishing operations. The beach seine fishermen occupied the land nearest to the area where seines could be operated, while the deep sea fishermen had their homes close to the area where they could safely beach their canoes [17]. This pattern is fast changing. Therefore documenting what has been and what is in existence becomes of significant importance.

The technological pattern of fishing can be categorized with reference to the locations. The first is deep-sea fishing in the area beyond the continental shelf, which is the area beyond 32 kilometres from the shore. The second is coastal line fishing in shallow waters, from the shore upto the continental shelf. This second location can also be categorized into two broad areas, namely the area of rocks and reefs and the Beach Seine area which is free of reefs and rocks. The third is brackish water fishing.

Traditionally, for deep sea fisheries and coastal line fisheries, outrigger canoes called *ruwal oru* in Sinhala have been used. Even at present a large number of fishermen use the outrigger canoe which is a relatively fast and stable craft. It is about 15 to 25 feet long and is a hollowed log, the sides of which are supported with planks. It is provided with a mast and boom for supporting a sail. This craft can reach 8 to 10 knots in moderate winds for distances not exceeding 36 kilometres from shore. The canoe can be easily launched and beached but it has limited working space for the fisherman. [18]

The construction of an outrigger canoe has been described in detail by V. Vitharana in his excellent treatise titled *the Oru and the Yatra*. According to this description the building of an *oru* starts with the selection of the most suitable tree with the required girth and maturity. The varieties of trees selected are mostly wild breadfruit (*Val del*), flame tree (*Mâra*) and Jak (*Kos*). The canoes made of Jak are the strongest and last for 20 to 25 years. Once the selected tree is felled its branches are lopped off and the maximum length of the tree secured. It is then hewed and the two ends tapered upwards with an adze. The top is slightly flattened, and two lines are drawn along its length with a solution

of charcoal and water marking the area within and beneath which the wood is to be scooped out. The adze, hammer and chisel are used for scooping. After the wood is scooped, both surfaces, inside and outside are planned, and the partially dug out *oru* is taken to the shore or the boat building yard for further attention. An elephant is usually used to drag the partially built canoe to the main road, from where it is transported away by motor lorry or cart.

Once the hull (*Katupota* or *Oru kanda*) is removed to the shore or the boat building yard a row of holes at approximately three inch spaces is bored along the edges lengthwise and planks with corresponding perforations are attached alongside to form the wash-strakes. The binding is composed of a lining of coconut frond, two inches in breadth over which two thin strands of coconut fibre rope are made to run in a design of two diagonals crossing within a rectangle. At the two ends of the wash strakes the angularly disposed transoms (each called a *midilla*) are similarly sewn. A smooth wooden lining is fixed to run over the wash strakes forming the gunwale (*pita poruwa*). For the wash strakes and gunwale mango (*amba*), *Dipterocarpus zelanicus* (*hora*), Jak (*kos*) and breadfruit (*del*) timber are used.

Between the gunwales short planks are fixed if desired, which may be used for sitting or for keeping various implements. Short rounded wooden nails (*äniya kotu, avara kotu*) are driven across the wash strakes with the ends jutting out on both sides. These are used for tying the rope ends and give added strength to the wash strakes.

Two booms are erected in the canoe horizontally; one in the centre and the other on a side for extending the sails. For the booms Alexandrian laurel (*domba*), *Rhizophora candallaria* (*Kadol*), Sappan wood (*Patangi*) or tulip tree (*Suriya*) timber is used. Long sticks are placed length-wise along each boom and are bound up tightly with coir rope to give added strength. By the central boom a thick block of wood in which a socket has been dug is placed and it is used for planting the mast. Certain canoes have double masts and suitable changes are made accordingly. Usually the mast is made of Alexandrian laurel (*domba*) or bamboo (*una*) timber.

Rings of coir rope are attached to the gunwales at convenient distances and these are used to take in the handles of the oars. The oar handle is made of the timber of breadfruit (*del*), Alexandrian laurel (*domba*), *Depterocarpus zelanicas* (*hora*), *Rhizophoray candallaria* (*kadol*), *Croton aromaticus* (*Keppitiya*) or *Albizia lebbeck* (*Surya mara*). For the oar blade mango (*amba*), satinwood (*burutha*), *Trichadenia zeylanica* (*halmilla*), *Ceylon oak* (*kon*) and Jak (*kos*) timber are used.

The rudder planks (*palla*) which are used for changing the direction of the canoe are attached at both ends of the vessel. They are made of satinwood (*Burutha*), *Trichandenia zeylanica* (*Halmilla*), *Albezia lebbek* (*Mâra*), *Haldina cordifolia* (*Kolon*) and *Manilkara hexandra* (*palu*) timber. [19]

The outrigger float (*kolläva*) is a simple log made of *Kohomba* or *lunumidella* attached pararell to the hull. It improves the balancing qualities of the canoe in rough waters. It is joined to the canoe by an arched attachment. This attachment has two arms made of stout branches of the *punna* tree (*Calophyllum inophylum*). There is no strict proportion between the length of the hull and the outrigger, but in all cases the latter is shorter.

The sail is mostly fixed on two masts; one of which is large and the other small. The sail is secured, lifted and manipulated by three ropes articulated to one another [20]. The cloth used for the sail is first shaped and stitched as required. It is usually white in colour or dyed brown by soaking in a dye. [21]

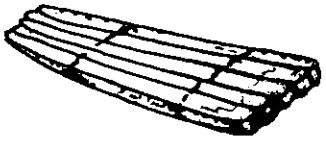
The above is a general description of the traditional outrigger canoe in Sri Lanka. But it has to be emphasized that there are variations depending on the region and the size of the vessel. For instance, some outrigger canoes are small and may be even five feet in length. They are called the *pilâ oru*. These small canoes do not have rudders and the fisherman turned the craft by manipulating the paddle. They are usually used in lagoons for rod fishing, setting up throw nets and traps and collecting the trapped fish. Some small, as well as some large canoes used in still waters do not contain masts and sails. When there are sails they also differ in appearance. Some are in the shape of a right angled triangle and some are either rectangular or square.

The sailless *däl oru* and *Mâdäl oru* are canoes some of which are over 25 feet in length. They are specially meant for net fishing in the lagoons and coastal line fishing in shallow waters and are widely used in Negambo, Chilaw and Batticaloa. The outrigger canoes used in deep sea fishing always have sails.

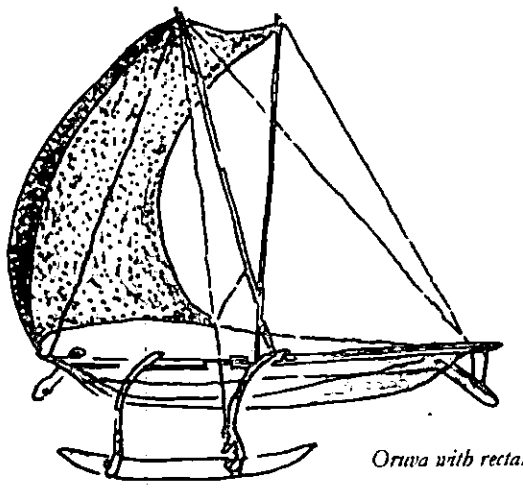
Oruva

Pāruwa

Vallama



Kattumarān



Oruwa with rectangular sail

Figure 14: Some traditional Fishing Crafts

The *Vallam oru* are used for net and bait fishing in the coastal line and are popular in the east coast from Panama in the south to Mullativu in the north and beyond the northern part of the Jaffna Peninsula. In Tamil they are called *thoni*. A few of the *Vallam oru* are also used in places such as Beruvala, Hikkaduva, Dodanduva, Ratgama and Gintota. The smaller versions of these dug-out canoes are about 8 feet long and 1 foot high while the large ones are about 20 feet long and two feet high[22]. The *vallam* is also made with planks on a frame. A detachable outrigger and sail are used when fishing outside shallow waters.

Apart from the outrigger canoe, the raft (*pâruva*) is another traditional craft used in fishing. It is perhaps the most ancient craft in the Indian Ocean. It is made of shaped logs lashed together by ropes and pegs. Mostly made of the Lunumidella (*Melia dubia*) logs, the raft is light and durable. Once launched into the sea it is rowed with oars and paddles. Some distance from the shore, the sails are spread out for riding light winds. The raft has a short mast and a large triangular or rectangular sails. Sailcloths are treated with a red dye to stop them decaying and are kept wet to increase wind resistance. The sails could be raised and lowered very quickly. When the sails are not in use they are simply wrapped around the mast. The sails could be used for a couple of years but the oars and paddles need to be replaced after a few months. The raft is usually used in inshore fishing upto a distance of 4 to 7 kilometres from the coast.

The life span of the raft varies between three and six years. Ideally, it should be dragged out of the water every day to prevent the wood becoming water logged. After prolonged use the rafts are dismantled and sun-dried on the sand and coconut oil rubbed into the logs. If a raft is not in use it is dismantled and covered with cadjans (plaited coconut fronds) to protect it against the weather.

The rafts are of two types. The large raft reaching a length of about 30 feet is called *Kattumâram*, the anglicized form of which is catamaran. The smaller type is about 9 to 15 feet long and is called *theppam*.

The Tamil term *Kattumâram* literally means tied logs. This craft has been initially developed south of the delta of the river Krishna on the Coromandel Coast of South India. The Sri Lankan catamaran is usually made of five or more logs. The central log extending from bow to stern is the frame to which other logs are lased together by ropes. It is not beached intact but is dismantled into separate logs which are carried ashore.

The *theppan* consists of three to four or occasionally five logs which are joined together by means of wooden pegs. The logs are known as *Kutti*. The two outer *Kuttis* are longer than the central ones, jutting out at the bow and the stern to form an anchorage for the rigging and as handholds when dragging or carrying the *theppan* up the beach. Holding the *Kutti* together are two 'spreaders' known as *kombo*; two thin sticks which pass through the logs near the bow and the stern, and secured by lashings over the top of the *kutti*. The bow is narrower than the stern and the two outer combo rises above the central ones to form a sort of bowl. Each *theppan* is made to order and varies slightly owing to the particular logs being used. The *theppan* is brought ashore on rollers which are often short lengths of coconut tree trunks. [23]

Fishing Gear

There are several types of traditional fishing gear which are still in use. Among them the hand line (*vala*) the angling rod (*pitta*), hook (*biliya* or *bili katta*) and the bait (*ämä*) form one unit. The rod

usually made of bamboo or the main rib of a *kitul* (*Caryota urens*) palm, bends without breaking so that it can easily take the weight of a fish. In the mid-twentieth century, hand lines were made of several strands of cotton thread woven together but now nylon threads have replaced them. About one foot of steel wire is attached to the hand line and at the very end is the hook. When fishing, baits are attached to the hook and the line is dropped into the water, jerked out and dropped again or swayed to and fro or jerked along the surface of the water. These variations of the movement depend on the whereabouts of fish.

Hand lines are extensively used for fishing bottom living fish which frequent submerged rocks or reefs. The fishermen travel to suitable locations at sea, in all types of craft and anchor at the fishing grounds. For anchoring, a stone weighing about 25 pounds attached to a rope is used in the south of Sri Lanka. On the East coast a stone weighing about ten pounds lashed to the end of a pole 3 to 4 feet long and attached to a rope is used. On the west coast metal weights attached to a somewhat pyramidal frame-work of sticks tied to a rope is used as anchor.

The line is lowered with the bait attached to the hook or the bait is sent alive in a small cage on the same or another line. This cage is cone-shaped with a lead ring round its open circular base. The live bait is trapped in the descending cone till it reaches the bottom where the cone tilts over and the bait, usually small shrimps, escape and attracts any passing fish. The fish attack the live shrimps and then follow up by biting the shrimps on hooks.

The same technique of hand line fishing is employed at a few places along the coast. Fishermen stand perched on vertical wooden stakes driven into firm coral reefs and angle from the vantage point for fish feeding on the reefs.

Plate 09: Reef fishing

A special form of rod and line fishing is carried out from canoes, planked *vallams* and rafts for the large shoals of skipjack (*balaya*) which approach the coastal waters. The fishermen first obtain the bait from shallow banks using dip nets for small-sized fish. This bait fish is kept alive by being trailed behind the craft in a wicker basket submerged in the water. The crafts then go in search of skipjack. When a shoal of fish is sighted the craft is taken into their midst and the live bait is thrown at them in handfuls. To excite the feeding skipjack, the fishermen splash the surface of the sea with their hands and oars. Each fisherman then lowers into the water a barbless unbaited hook attached to a string line and bamboo pole. When an excited fish bites the shiny hook, it is quickly lifted into the craft and the hook being barbless is easily flicked free and is thrown back into the water, allowing the speedy repetition of this operation. Great care is taken to prevent a hooked fish jumping back into the sea as the presence of a hurt and disturbed fish can cause panic and send the whole shoal into flight.

Plate 10: Beach Seine being pulled ashore

The most important fishing gear in Sri Lanka is the beach seine (*mâ däl*). They are carried in dug-out canoes and rafts and are used for laying in the water. To set a beach seine, the end of one hauling rope is fixed on shore and the vessel goes out with the net, laying it out along an arched course till the free end of the second rope is brought to the beach at a point over 100 yards from the first end. Then it is a matter of hauling in the net. Twenty to seventy men are usually required for hauling in the net, but when the current and wind are against the course of the net 40 to 50 men are required on each rope. At present the beach seine fishery contributes the greatest share, i.e. about 35 to 40 percent of the total fish landings of the island.

The average beach seine net consists of a 10 to 15 feet long bag of small meshed netting called the cod end, which can hold 1 ½ to 2 tons of fish. This is attached to the body of the net which is a 40 feet long cone with sections of different sized meshes, small near the cod end and bigger towards

the free end. The wide-meshed wings attached to the body which narrow down to mere strips of netting are finally attached to hauling ropes. The wings are 25 to 40 feet long and the ropes about 1500 feet each. The overall dimensions and the mesh size of the cod end vary slightly according to operating conditions and nature of fish shoals to be encircled. Coir is used for making the final parts of the wings and hauling rope. The netting of the cod end, body and four-part of the wings is generally made from cotton or hemp twine. When completely set out the seine may measure more than three miles in length and when wet it may weigh more than two tons.

The beach-seine nets are set out in areas such as Marawila, only when a shoal is sighted. In other areas the net is just set and hauled a few times in the early morning, the results of which determines the further operations for that day. [24]

The gill nets (*Ælana däl* or *katti däl*) are of equal importance in inshore fishing and are set across the path of moving fish. There are two kinds of gill nets: drift gill nets and bottom set gill nets. Nets, originally made of cotton or hemp are now mostly manufactured of nylon or other synthetic fibres. Drift gill nets are hung from surface buoys or wooden floats with weights along the lower edge to stretch them so that they can drift along with current. The bottom set gill nets have their lower edges heavily weighted down usually with coral stones, so that they sink deep in the sea. The top edges have wooden floats strung along to keep the whole net up. The lengths of the nets used vary and depend on the number of small nets which are strung together. A normal set of gill nets consists of 8 small nets each of which sinks down to a depth of 2 fathoms, and is 48 metres in length.

When a fish comes up against the net, it pushes its head through the mesh, and gets entangled between the expanded gills of the net. The size of the meshes or interspaces are 13 to 180 millimetres, and determine the kind and size of the fish the net can catch. Several names are used for those nets such as seer net (*Tòra däla*), mackerel net (*Kumbalà däla*), sardine net (*Hurulu däla* and *Sálayá däla*), crab net (*Kakulu däla*), shark net (*Mòra däla*) and rayfish net (*Madhu málu däla*). [25]

A modified version of a fine-meshed seine net is operated in lagoons by two men each in his own canoe or raft. The bag and one of the wings with its rope are laid out from one craft which keeps moving, while the second craft is rowed around it in a wide circle, while laying at the same time the second wing and its rope. Thin strips of tender coconut leaflets tied along the ropes flutter in the water driving the fish towards the bag and the net is hauled up by the two men. This net is principally used for taking cat-fish (*Angulunwa*). [26]

Another kind of net used in traditional fishing is the hand net (*at däla*) or throw net (*Visi däla*). These nets are about 3 metres in diameter with lead weights (*baru*) attached to the edge. They are cast into the water with a twist of the elbow. These small nets are usually used in lagoons, brackish water and by the seashore and are employed to catch a variety of small-sized fish. When cast into the water, these nets sink rapidly because of its marginal ring of lead weights and are slowly drawn into a closed bag, using the rope round its circumference. Its contents of fish are then emptied into a basket. [27]

One of the means of catching shrimps in brackish waters is by noosing them. The noose consists of the fine fibres of the plantain tree attached to the rib of a coconut leaflet or merely the end fibre of a leaflet, tied back on itself in a loop. The noose is lowered over the protruding eye-stalk of a resting shrimp and is tightened and lifted.

Another method of fishing for shrimps is by trapping them with stake nets. A typical stake net consists of a small seine net with wings 10 yards long and a cone-shaped body and with cod ends about 5 yards long. The nets are staked in the lagoons in such a manner, that the lower edge lies along the bottom of the lagoon and the top edge above water. The shrimps moving into the sea with the outgoing tide reach the fine-meshed cod end. In the night a lighted lamp is kept near the cod end as an added attraction for shrimps. The fishermen visit the locality at intervals in canoes or rafts, to collect the catch.

Another kind of stake net consisting of gill netting placed across the flowing water is used for catching migrating species such as mullets and milk fish. They are mostly used in lagoons.

An extraordinary fishing method in the lagoons is the use of brush piles to attract fish to one spot before netting them. Masses of leafy branches are placed in the water and held down by stakes if currents tend to move them. In some cases fishermen scatter burnt coconut poonac and grain around the pile, to entice fish. After about half an hour a cast net is used around the pile to catch the fish. In some other cases larger piles are left in the water for about a month to grow algae which attract the fish. Thereafter, fishing is conducted with a fine meshed-net or with a large hand net.

Trapping is another form of fishing practiced in brackish waters as well as in shallow areas. The simplest form of trap is a cone-shaped basket called *Karaka* in Sinhala. It is made of bamboo strips or rattan and is open at its wide base as well as the narrow apex. The apex opening is just large enough to insert a human arm. The fisherman wades across shallow banks and presses down the basket in places likely to shelter small fish or shrimps. Then he puts his hand through the top opening and picks out the catch.

Rectangular or square basket traps with one to three inwardly-directed conical entrances leading to a chambered interior are used in lagoons and estuaries to catch fish and crabs. Canoes are used to reach suitable locations and traps are lowered from the canoe by a long string to lie on or near the bottom.

A simple trap used for the lagoon crabs especially at Negambo, consists of a circle of cane to which a stretched piece of wide-mesh is fixed. The circle has a diameter of about 2 feet. This trap is suspended from a float by short strings tied to the hoop to keep the trap horizontal and prevent it from tilting. Several of these traps, with small fish or meat offal as bait, are laid from a vessel and are periodically lifted up quickly, to catch crabs feeding on the bait. Crabs seldom escape as their legs get entangled in the netting with the rapid lifting of the trap.

Trapping fish particularly in estuaries is also done by erecting strips of bamboo and tying them with coir rope to form a barricade. This barricade has very narrow spaces between the strips, allowing only for the flow of water. Fish and shrimps encountering the palisade are directed into a varying number of traps. At night lamps are suspended over these traps to act as lures for fish. In places such as the Balapitiya lagoon, a rope net several feet wide is stretched along the top of the enclosure to trap fish which may jump over the barricade[28].

Methods of Curing Fish

The practice of drying fish became widespread only after the arrival of the Europeans in the sixteenth century. Presently, fish is cured in some traditional fishing villages by using four methods; namely drying without salting, dry curing of salted fish, smoking and wet curing of salted fish.

The method of drying without cleaning or addition of salt is applied only in relation to small fish such as sprats. This simple system of drying sprats was common in the dry zone beaches several decades ago, but now it is commercially done only in the Mannar region.

The dry curing of salted fish is practiced throughout the coastal areas when there are abundant quantities of fish. The method is completely dependent on the hot sun and therefore is used only in the dry season. In this process, the fish are first cleaned, then salted and sun-dried. The varieties of fish used for sun-drying are mostly skipjack (*Balayâ*), seer fish (*Tòra*), cat fish (*Anguluva*), flying fish (*Pihámässâ*), Herring (*Sálayá* and *Hurullâ*), Sardine (*Sùdayâ*), mackerel (*Kumbalávâ*), horse mackerel (*Paráva*), cuttle fish (*Dälla*), pony fish (*Kárallâ*), shark (*Mòra*) and shrimps (*issâ*).

Plate 11: Dry Curing of fish

The method of smoking is applied only in relation to skipjack (*Balayâ*) in the preparation of what is called Maldive fish. It is also done mainly as a cottage industry. The fish after being cleaned are boiled. Thereafter they are smoked for several days before sun-drying. This process gives a hard cured product which is in demand as a food seasoning. [29]

The wet curing method or *jádi* preparation technique could be applied independent of the weather. The fish are first cleaned and washed in sea water. Then dried pulp of *Goraka* (*Garnicia cambogia*) is added to the fish. Acidic *Goraka* tones down the sharp taste of the salt in the final product and makes the cured product a type of pickled fish. The fish is packed in wooden or clay containers. The metal utensils are purposely avoided because acid in *Goraka* coming into contact with metal invariably lead into food poisoning. The packed fish is tightly sealed and kept for fermentation for periods varying from two to three weeks. [30]

Organization of Traditional Fishing Communities

In concluding this chapter it is appropriate to discuss briefly some social aspects of traditional fishing communities. One of the distinctive features of the fishing communities in Sri Lanka, is that socially they belong to one particular caste. This fishing caste is referred to as the *Karáwa* among the Sinhalese and the *Karayar* among the Tamils. A substantial number of fisher families in this caste profess Christianity and in places such as Negambo, Chilaw, Wadduva and Maravila 10 percent of the proceeds from the catch are donated to the Church. The church in return utilizes this money for the welfare of the fishermen within its parish.A substantial number of fishermen in the Eastern coast and the majority at Puttalam, Beruwala and Hambantota in the Western coast are Muslims. They do not have any caste distinctions but are stratified according to the economic status. But all fishing groups belonging to all three communities adhere to tradition, convention and religious beliefs and

practices. Thus, the Christians do not fish on Sundays, the Buddhists on Poya days, particularly on full-moon Poya days and the Muslims on Fridays.

In most areas fishing is conducted as a family activity. Sons assist their fathers and accompany them to sea while the womenfolk mend the nets, dry and salt the fish and sometimes undertake the selling. The role of women in fishing varies from area to area. At places such as Mutwal and Negambo for example, women do most of the bargaining and selling but in the southern coastal areas they are little involved in commercial aspects of fishing. (31)

In the traditional system petty fish traders played a great role in marketing. Households obtained their requirements of fish through pingo carriers (*Katkárayo*) and vendors who sold fish on bicycles. While these traditions continue today, large scale sale of fish is handled by entrepreneurs.

These entrepreneurs or middlemen between the fishermen and the consumers do not belong to any one particular caste. They are of almost all castes, an indicator that caste barriers have not restricted upward social mobility. These entrepreneurs were the owners of most fishing crafts, beach seine nets and other fishing equipment. Those well experienced in fishing and rowing canoes were also entrepreneurs and in the traditional system they were called *Marakkalahe*. The richest of the managerial class owned even Lorries for the transport of fish to main centres of distribution. The entrepreneurs sometimes advanced money as loans to the poor sections of the fishing families, and continue to maintain the link and bondage between them and the fishermen.

The society in fishing villages has been stratified in accordance with occupational patterns and income levels. Entrepreneurs form one social class but among them too there were status differences, depending on their income levels and managerial abilities, such as organizing fishing activities and accounting.

Below the entrepreneur class were those who were actively involved in fishing and lived solely on their labour, i.e. hauling seine nets, manning canoes and undertaking individual fishing operations. They formed a lower status group. Those who undertook individual fishing operations did so for subsistence rather than for commercial purposes. But if the catch was considerable they sold it at a nominal price. (32)

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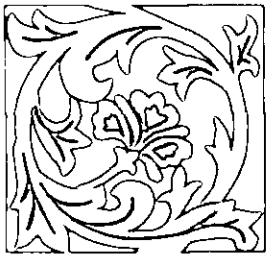

CHAPTER V

INLAND FISHERIES

Historical Background

The artificially created small and large irrigation works and the natural rivers, streams and ponds in addition to their primary function have been good grounds for inland fishing throughout history. These continue to be sources of fish even at present. In fact, inland fishing started with pre-historic man and remains of fish which were used as food have been found in fossiliferous deposits in several pre-historic excavation sites.

After the dawn of civilization inland fishing became an important economic activity. In early historical times, beginning approximately from the third century B.C., the majority of the population lived in villages far away from the sea coast. Most of the agricultural villages were located in the Dry Zone lowlands as the coastal belt was not suitable for producing the main staple, rice. The communication system at the time was also rudimentary. Therefore, fresh sea fish could not be brought into the interior villages in a condition fit enough for consumption. As such, fish for the average villager's consumption was obtained from inland waters.

It may be appropriate here to touch briefly on the subject of the dietary habits of the people in ancient Sri Lanka, including Buddhist monks. Rice was the staple diet which was supplemented with vegetables including herbs, cereals and milk. Meat was consumed by a few and fish by many. As Wilhelm Geiger has pointed out, fish in various forms including dried fish was eaten with rice but rarely meat [1]. However, a diet which included meat and fish (*Matsya-Mánsa*) was considered a sumptuous one and sometimes meat and fish were even included in the meal monks were offered as alms. [2]

There had not been strict prohibition on the consumption of meat or fish in Buddhism [3]. In the *Jivaka Sutta* or the Discourse to Jivaka, the Lord Buddha prohibited the eating of meat and fish by monks only if it was seen, heard or suspected that the animal had been killed solely for the purpose of offering it to a monk. In the same *sutta*, the Lord Buddha specifically approved of the consumption of fish and meat by monks "if it is not seen, heard, [and] suspected [to have been killed on purpose] for a monk. [4]

In a few inscriptions dating from the third century B.C. to the first century A.D., indited on rocks at Bovattegala in the Ampara District and Kottademuhela and Hennanegala by the river Mundenu Aru, the symbol of fish has been marked [5]. Some of the ancient punch-marked coins too contain the symbol of the fish. These are only indications of the importance attached to fish, but the earliest reference to fishing in reservoirs and canals is found in the Perimiyankulama rock inscription of King Vasabha (67-111 A.D.).

This inscription is indited on a rock just outside the present urban limits of Anuradhapura. It states that revenues from water and fish of the reservoirs Polonakaraka and Ketavalaka in the District of Tihalaka were granted to the village assemblies at Tiragama and Amara for the purpose of spreading leopard skins in the meditation halls of the temples in the respective villages [6]. The original *vinaya* rules made no provision for such eventualities like accepting gifts of land and share or tax on fish, because Buddhist monks in those early times did not accept these gifts. But the *bhikkhu* community later compromised on these rules, in an effort to adapt to the social conditions of the time. Such gifts were accepted, on behalf of the bhikkhu community, by a group of lay disciples known as *Kappiyakâraka*.

The term used in the Perimiyankulam inscription for the tax on fishing or the share of fish caught in reservoirs is *Materamajibika*. This tax in various forms, such as *matara majibika, matira majibika* and *majibika* is referred to in several other inscriptions in the period from the first century A.D. to the end of the third century. [7]

This indicates that fishing in reservoirs and channels, besides natural rivers and streams was widespread in the early Anuradhapura period. The fifth century Pali treatise *Papancasúdani*, commentary of Buddhaghosha on *Majjhima Nikaya* refers to the term *Maccabhâga* [8] which means the share of fish caught in the reservoirs and canals. This share was claimed undoubtedly by the owners of irrigation works; the king in the case of large irrigation works, village assemblies in the case of village irrigation works and individuals in the case of privately owned small reservoirs and channels.

The fish in large reservoirs and channels constructed by the king were owned by the state. Paranavithana is of the opinion that on certain occasions, fishing rights in large irrigation works were farmed out to individuals by the king [9]. A tax on fishing in rivers is never mentioned in either literature or epigraphy and perhaps it may be owing to the fact that it was difficult to have a check on fishing in such places.

The village assemblies held the proprietorship of fish in village irrigation works considered to be common village property. Private individuals were the third category of proprietors of fish. The *Samantapâsâdikâ* specially refers to privately owned fish (*sassâmika*) in small reservoirs, ponds and channels. These small reservoirs were held by individual owners (*vapihamika*). Channels were individually owned smaller ones that branched off from the main channels, which led water into private paddy fields. Most individually owned channels passed through the paddy fields while others

skirted around them. The ponds were those constructed by individuals in their homesteads for domestic and agricultural uses and for breeding fish. The *Samantapâsâdikâ* clearly states that catching fish in these privately owned streams, ponds and reservoirs by outsiders was a theft and those found guilty of such theft were to be punished in accordance with the value of fish caught.[10] Similar types of ownership continue to be in existence in the island.

The earlier mentioned tax on inland fisheries continued until the twelfth century, perhaps with occasional interruptions. For example, the Basavakkulama Pillar inscription of Sena II (853-887) states that fishing in the Abhayavava situated by the side of Mahâvihâra at Anuradhapura was prohibited [11]. This means that fishing in other reservoirs was approved of by the king, but there is no clear evidence that the tax on fishing in approved reservoirs was in existence at this particular period. However, by the time King Nissankamalla (1187-1196) ascended the throne there had been a tax on fishing in reservoirs. Nissankamalla in several of his inscriptions claims to have abolished the levying of an impost on fishing in reservoirs, called *pisamburuvata* or *visamburuvata.* [12]

After the hydraulic civilization had declined, people in the isolated pockets of settlements in the Dry Zone as well as those who lived closer to rivers and streams in the Wet Zone continued fishing in inland waters to supplement their diet. Robert Knox in the seventeenth century and several other British writers later on have referred to inland fishing in various forms but there were no taxes charged on inland fishing from the thirteenth century onwards.

Fish culture also has been prevalent in the island at least on a minor scale from ancient times. The fifth century commentator Buddhaghosha expressly states that some people brought fish from state owned large irrigation works and also from village irrigation works, bred them in small ponds in the back gardens of their homesteads and caught two or three daily for their meals. In another instance too, Buddhaghosha refers to the rearing of fish by individuals in small streams and reservoirs [13]. Nearly twelve centuries thereafter Robert Knox stated that fish had been nourished and fed by the king's order at a "passage-place" near the city of Kandy for the pleasure of the king but not for consumption [14]. However, Knox in discussing the dietary habits of the king and the nobility in the Kandyan kingdom categorically states that they have always five or six sorts of food at one meal and not above one or two at most of flesh [15] or fish. [16]

Some attempts at developing an inland fish culture had been made from about the end of the nineteenth century, by expanding the habitats of the fresh water fish, and by introducing exotic varieties of fish into the inland waters. Ponds were constructed in Kalutara in 1908 for the raising of fresh water fish Etroplus (*Koraliya*), but the experiment failed when the ponds went under water during the following year. Attempts were made in 1928 and 1932 to acclematize brackish water species into a fresh-water pond but the numbers involved were too small to be of any significance. [17]

The introduction of exotic varieties of fish although unsuccessful at the beginning has contributed a lot to the development of the inland fisheries industry in the recent past. Exotic varieties of fish have been introduced because there were no indigenous fish species of rapid growth and prolification and of commercial significance. Two varieties; Trout and Gourami were introduced in 1882 and 1910 respectively [18]. Gourami were first introduced into a pond at the Royal Botanical Gardens at Peradeniya but within a year these fish escaped into the Mahaveli river during the floods. However, subsequently Trout and Gourami have established themselves in the inland waters of the island.

A new era in the inland fisheries industry began with the introduction of two hybrid varieties of fish namely, *Tilapia mosambica* and snake skin *Gourami* in 1951. A shipment of 2,500 *Tilapia* were

imported from Malaya in that year and stocked in the Fisheries Research Station in Colombo. *Tilapia* is now common in inland waters upto an altitude of 4,000 feet above sea level. Over 9,000 snake skin *Gourami* were imported from Java in the same year. They were introduced into the ponds of the Fisheries Research Station in Colombo and later into the fresh waters of the low country [19]. Subsequently another hybrid variety, i.e. Common Carp has been introduced into the island.

Present Status

Presently large scale commercial inland fisheries are confined to big reservoirs and the harvest mostly consists of *Tilapia*, Carp and *Gourami*. However, small scale fishermen who fish in shallow pools, rivers, ponds and streams catch many varieties of fish which are indigenous and have frequented the water bodies of the island from ancient times.

One of the most important of these is *Lúla* or Snake head (*Ophicephalus straitus*). The *Lúla* (*viral* in Tamil) does not exceed 750 mm in length but it does not have numerous intramuscular bones. It is prescribed as a diet for invalids and pregnant mothers owing to its digestibility and the absence of cloying fat. The *Lúla* is also much esteemed when dried in the sun. [20]

Walaya or fresh water shark (*Wallago attu*) is the largest indigenous fish and grows to about 1250 mm. The *Walaya* contrary to its Sinhala meaning, "the one who lives in the pit" is chiefly found in deep flowing water in rivers and sometimes in reservoirs. Besides Sri Lanka, they are found in India, Thailand, Myanmar, Java and Sumatra. [21]

The most common indigenous fish is *kudamassa*, i.e. common rasbora (*Rasbora daniconius*). In ancient literature a poor person's meal is at times is referred to as consisting of cooked unpolished rice and a curry made with *Kudamassa* [22]. The *Kudamassa* is a small fish which often has a large yellow blotch on the back visible while it is in the water.[23]

Ándâ or eel (*Genus anguilla*) and *Kâvayyâ* are two other local varieties consumed by the villagers. *Ándâ* grows upto about 600 mm. The *Kâvayyâ* is a unique fish because it can move on even on uneven ground, from one drying pond to another for considerable distances. The *Kâvayyâ* has on its head special adaptations which enable it to breathe on land.

Peityo or Puntius (*Barbus* spp.) are also a kind of common inland fish which could be mostly found in flowing waters. Deraniyagala refers to six varieties of this fish namely *Dankola Petiyâ, Handa Petiyâ, Katu Petiyâ, Kota Petiyâ, Mas Petiyâ, and Velankola Petiyâ* [24]. The belly and the ventral side of all varieties of *Petiyâs* are either silvery or whitish in colour.

Gangâra or Giant Snakehead (*Channa marulius*) is a large fresh water fish growing upto a length of over 800 mm. It is sometimes pale olive and yellow in colour and has a diffuse violet lateral band. It is found in streams, rivers and irrigation reservoirs upto an elevation of 1,500 feet and is a popular food fish among the people living in inland regions. [25]

Issa or shrimp (*Carridina spp.* and *Macrobarachium spp.*) are also being fished, particularly in the Mahaveli River. Some locations such as Manampitiya are famous for inland shrimps, which are tastier than the sea or lagoon shirmps. The shell of the inland shirmps is also hardier than the other varieties.

The present day commercial scale inland fisheries, as stated earlier, are confined to three varieties *Tilapia*, *Carp* and *Gourami*. Of these the most commonly found are the first variety namely *Tilapia*. Almost all commercial scale fisheries are conducted in man made reservoirs like Padaviya, Nuvara Vava, Kala Vava etc.

Many characteristics of the reservoir fishery remain uniform throughout the island. The craft employed is usually a dug-out canoe or a log raft paddled by two men. These crafts, however, are being gradually replaced by fibre-glass boats similar in appearance to the dug-out canoe. The fishery is essentially a gill-net fishery, where the mesh size ranges from 8-12 cm. The gill-nets are laid at sunset or little later and hauled at dawn. The bottom topography of reservoirs as well as numerous obstructions, particularly the tree trunks prevent any other bottom gear being used. Restrictions have been imposed on the minimum permissible mesh size in order to avoid very small fish and fry being caught. This restriction, together with the complete prohibition of seining, has led to a certain amount of conservation of the fish stocks in the reservoirs. [26]

Traditional Fishing Techniques

One of the indigenous means of inland fishing used from time immemorial is an implement called the *Karaka*, or the *Karak gediya*. It is a basket like implement broad at the bottom and narrow at the top. Made of either small but hard and flexible wooden sticks or rattan it is shaped like a funnel. Both bottom and top ends are open and the opening on top is large enough for a man to thrust his arm in. It is about two or three feet wide at the bottom. The fisher operates the *Karaka* from the edge of a river, stream, tank or pond. If the water course is shallow he operates it by wading in the water. The *Karaka* is placed at the bottom of the water and the fish that are trapped in it are caught by hand.

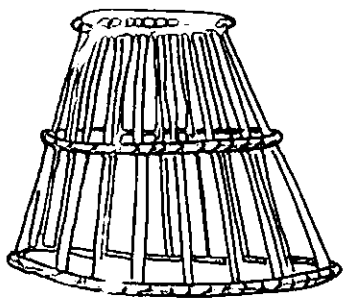

Figure 15: *Karaka*

In this method, occasionally portions of a shallow stream, lake canal or other water course is dammed and drained by bailing the water. Sometimes all the water is not bailed out. When a sufficient amount to enable wading is emptied, the area is beaten out so that it becomes a muddy pool. The fresh water fish blinded by the mud come up to the surface and float on top. Then the fish is killed with a stick or caught by the *Karaka* or hands. [27]

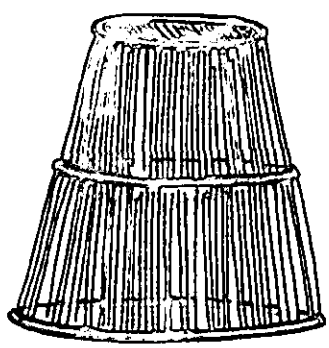

Figure 16: *Iratiya*

An implement similar to the *Karaka* but mainly used in the shallow waters of the Dry Zone is known as the *iratiya*. The only difference between the *Karaka* and *iratiya* is that the distance between sticks in the *iratiya* is very much less than that in the *Karaka*. The sticks used in the former are also thinner than those in the latter. Thus even very small fish get entangled in the *iratiya*.

A traditional wicker work contrivance known as the *Kemana* which could trap fish is set up in mid stream of rivers or in flowing water of small streams. It is an instrument like a long basket with a closed bottom end. This closed bottom end is wide whereas the opened top end is smaller in size. The *Kemana* is also made of hard but small wooden sticks or rattan. The *Kemana* is usually placed after

sunset with the burning oil lamps placed close by. Unlike the *Karaka* it is placed vertically at a suitable spot in flowing water. The fish that are trapped in this implement have no means of escape and the fisherman collects them by hand in the early hours of the morning.

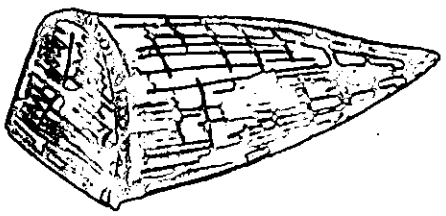

Figure 17: Kemana

A variety of throwing nets both large and small are still being used by traditional fishermen in wider stretches of rivers as well as in reservoirs. They are made of a fibre obtained from a tree called *niyanda* (*Sansevieria zeylanica*). Threads made of this fibre are stronger than of coir, however they are being increasingly replaced by nylon threads.

Of these nets, the traditional net called *athangoo* deserves special attention. The *athangoo* is a large hand-net, with a rounded or elliptical framework made of bamboo, rattan or some other pliable jungle stick. It is portable and can be carried over long distances. In this method of fishing, the rural fishermen, after selecting a suitable pond or any other large sheet of fresh water, bury their *athangoos* in a horizontal position in the bed of the shallow water, making only the top of the stick-handle appear above the surface.

Each man in addition to his net, has a long stick with a curve at one end roughly resembling a hockey stick and with this he goes round the buried net, beating the water with the stick. In this manner the excited fish are driven into the trap net which is almost entirely submerged. This process is repeated several times and finally the fisherman raises the net vertically with a sudden jerk. [28]

The rod and line method of fishing is used islandwide, both at sea and inland waters. The method could be employed in many circumstances in deep and dangerous areas, where other methods cannot be used. Fishing with the line could be done from the bank of a stream, reservoir or pond or from a canoe on the river or reservoir. Usually the rod (*bili liya*) consists of a well-grown and mature branch of the *kitul* (*Caryota urens*) palm. The line (*bili ipila, bili noola, bili vala*) is a woven thread discoloured and waxed. The hook (*biliya, bili kokka*) is usually made of iron or steel. The baits used in rod and line fishing are earth-worms, red ant eggs or very small live fish. [29]

Figure 18: Atanguva

However, in certain regions there had been and there is a stigma attached to the rod and line fishing. The term *bilivedda* is often used in ancient literature in a derogatory sense to a jungle man of the Vedda tribe who lived solely by fishing and hunting. In the seventeenth century, Knox has referred to various techniques of fishing in the Kandyan kingdom but not to the rod and line. [30]

Henrey Parker, referring to the Kandyan areas in the nineteenth century states "unlike low country Sinhalese they never fish with the hook, a peculiarity that they share with the *Wanniyas* [people of the Vanni regions in the Dry Zone] and nearly all Kandian Sinhalese who for some reason unkown even to themselves hold that it is quite improper to do so" [31]. Parker, in a foot note further points out that the stigma attached to the hook was not peculiar to inland Sri Lanka but was so even in some parts of the ancient Mediterranean areas. Citing Plutrach, he states that the natives of Oxyrhynchus in ancient Egypt did not eat fish that had been caught with a hook. [32]

In present day Sri Lanka there is no general condemnation of fishing with the hook in inland waters, but in certain localities the disapproval can still be observed. For example, in villages such as Likolapitiya, Monnekulama, Giriulla, Kirinda, Olupaliyâva and Vanduressa in the Vanni Hatpattu, the use of the rod and line for fishing is not approved of and looked down upon.

Stupefying the fish by means of poisonous leaves, fruits or roots thrown into the water, is a traditional practice that has long been in existence, but it is fast dying out due to the fear of food poisoning. For stupefying, usually the crushed leaves of *Timbiri* tree (*Doispyros embroypteris*) or the crushed fruit of the *Kukurumahan* bush (*Randia dumetorrum*) or the crushed roots of a species of creepers called *Kala väl* (*Derris scandeous*) are thrown into pools frequented by fish.

Figure 19: Anabola

The Veddas of Maha Oya used to wrap *attana* (*Datura metel*) in a piece of cloth, and crush it against a hard surface. They then immerse the smashed up bundle in a jungle pool. The fish are rendered stuporose by the action of atropine found in the seeds, and tend to rise to the surface. They are caught before they die and transferred into fresh water till they recover. The recovery of fish is a sign that the effects of atropine have waned off, fish is then killed and taken for consumption. [33]

Large as well as small reservoirs spill during heavy rains and some of the fish living in them come out with spill water. In such instances villagers assemble below the spill and kill the fish with iron rods or swords. This is called *Mâlu kotanavâ.*

During periods of drought, when reservoirs become virtually dry, leaving patches of water in the centre and near the spill, fishing in village reservoirs is prohibited by convention. The enforcement of the prohibition was entrusted to the village elder known as *Vidâne.* The *Vidâne* fixes bundles of sticks or a strong pole with dried leaves on top in places where water remains. This process is called *ana bôl bandinavâ.* However, if drought prolongs and indications of drying up of the reservoir completely are strong the *Vidâne* decides to allow fishing for the whole community.

The date for such communal fishing is announced by the *Vidâne* and on the stipulated day one male member from each family is expected to assemble at the reservoir in the early hours of the morning after sunrise. Each male brings utensils known as the *iratiya* and *karaka* for the exercise.

Before the commencement of fishing the *Vidâne* performs rituals to appease the gods and prays that fishing is conducted as the fish are about to die due to drought. Thereafter the *Vidâne* removes the *ana bôl* and the fishing commences. Fishing is done by placing the *karakas* and *iratiyas* in the water and the trapped fish are taken by hand. All the fish that is collected is kept in heaps on the dried tank bed. When the process is complete the *Vidâne* orders fishing to be stopped.

Then the *Vidâne* and the crowd set aside fish portions for mothers with infants, pregnant mothers, the washerman, the village headman, the native physician of the village etc. Thereafter, the fish left over are divided equally among all families that participated in the fishing. Once the communal fishing was over, there were no more prohibitions on fishing on any subsequent day.

In this context it is of interest to understand the methods by which fish is preserved for days, weeks or months, by the villagers in the interior. In the North Central Province, fish for domestic consumption is kept for several weeks by a system known as the *kurukkale damîma*. The only fish that could be preserved in this form are *Lîlâ*, *Valayâ* and *ândâ* which have a considerable fat content. The fish is sliced into small pieces, salted and boiled with no added water. The fat keeps the fish boiling. Once the fish has boiled completely, chilli powder is added and the fish simmered for about fifteen minutes. The fish prepared in this form could be kept for several weeks, provided the mixture does not come into contact with water.

The traditional method of drying of fish is somewhat similar to the means practiced in the sea coast. The fish is cleaned, split open and placed on rocks but laid out on a *messa* or platform, constructed in the open so that there is sufficient sun light. A fire is lit under the *messa* and the sun light and smoke help in drying the fish.

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