

## **A PRELIMINARY SURVEY ON SOME SOCIO ECONOMIC ASPECTS OF THE HUMAN COMMUNITIES OF MAHA-OYA, KELANI GANGA & BOLGODA / PANADURA ESTUARIES OF SRI LANKA.**

by

**Ajantha de Alwis \***

*National Aquatic Resources Agency*

### **INTRODUCTION**

Estuaries play an important role in the coastal fisheries production. The mangrove flora which are associated with the estuaries contribute nutrients to the systems making them biologically productive. Most of the commercially important fish and shell-fish depend on the estuarine environment during one stage or the other of their life history for spawning, feeding etc. (Odum, 1971; Macnae, 1974, Martosubroto and Naamin, 1977).

In the recent past, urbanization, industrialization and tourism had made considerable damage to this eco-system. It is now time though late, to control development activities to safeguard these biologically productive estuarine areas.

A broad knowledge on physical, chemical and biological parameters as well as the socio-economic significance of the estuarine systems is important in formulating a managerial structure for rational management of this important eco-system.

In this preliminary study, an attempt is made to observe some socio-economic aspects of three important estuaries of Sri Lanka, Maha Oya, Kelani Ganga and Bolgoda/Panadura. Human dependence on the estuarine system to earn their living is emphasized. Observations are also made on other economic uses of the system.

### **MATERIALS AND METHODS**

Materials for this study were collected over a period of two months from August to October 1986.

Demarcation of the landward limit of the estuary was not difficult in the Maha Oya as a dam has been erected about 6.5 km from the sea mouth stopping sea water penetration beyond. In Bolgoda/Panadura and Kelani estuaries, this posed a problem as definite sea water demarcation points were not available, as such in this study they were fixed on the basis of information gathered from the people living in the respective areas on the distance of seawater penetration. Each estuary was visited 4 days during the study period. A boat was utilized to visit sites where activities were going on (eg. mining sites, fish kraals etc.)

\* *Present Address- Department of Zoology, University of Sri Jayawardenapura, Nugegoda,*

Data were collected in the field by questioning personnel involved in different activities in the estuaries and by personal observations. Fishermen and sandminers were interviewed at their relevant places of work.

Sample size was based on the number of people involved in a particular vocation (25% of the total number involved were questioned). Special care was taken to select a representative sample of the communities. Data on fishermen using fishing crafts issued by the Ministry of Fisheries were obtained from the Inland Fisheries Division and Data Processing Division of the Ministry of Fisheries. Other statistical data were obtained from the Department of Census and Statistics.

## RESULT

### GENERAL DESCRIPTION OF THE STUDY AREAS

Location of the three estuarine systems are given in Fig. 1.

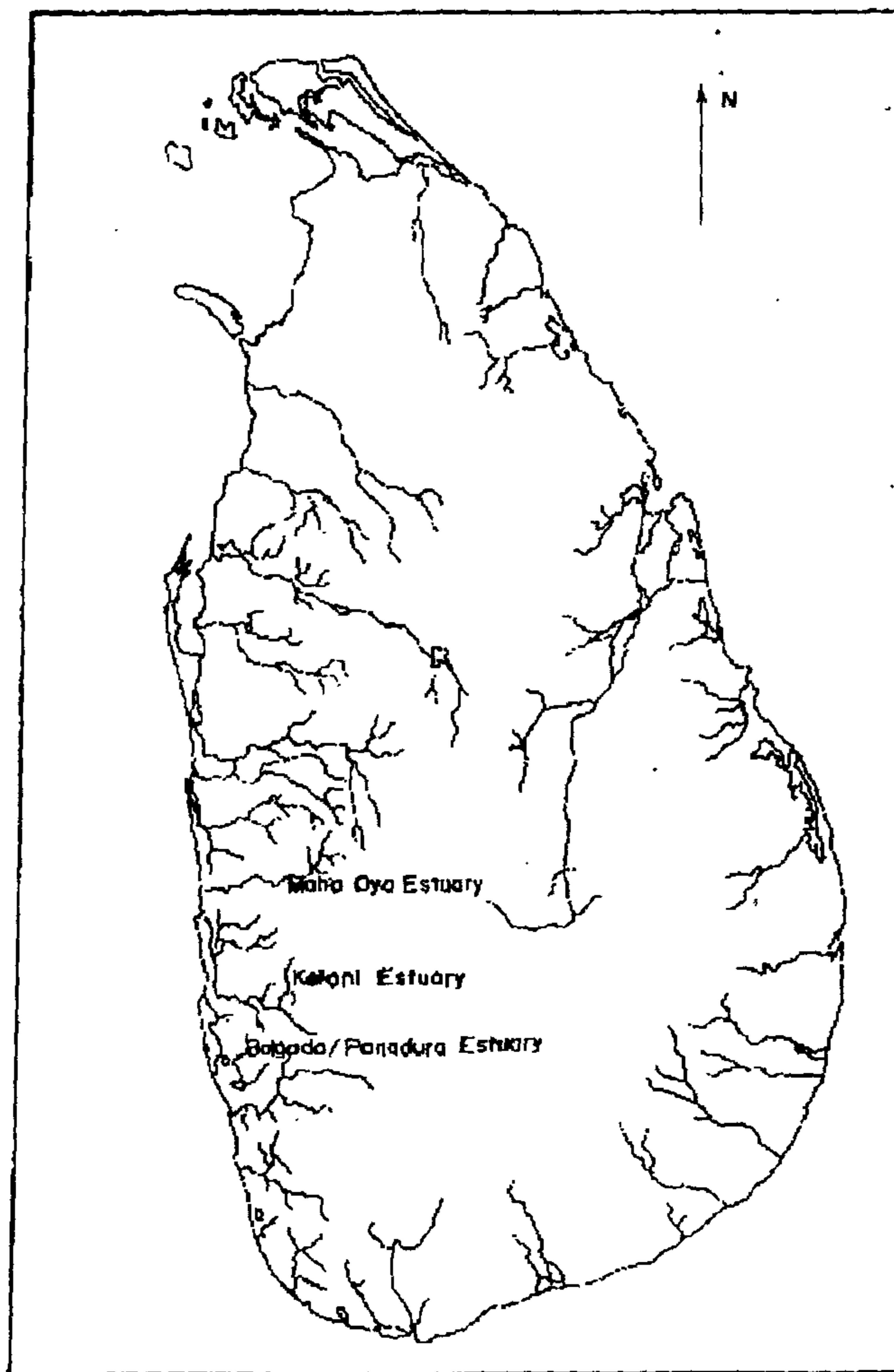


Fig. 1 - Locations of estuaries studied

### MAHA OYA ESTUARY

Maha Oya estuary is located in the wet climatic zone of the west coast (Fig. 2) and it extends upto a point in Katana electorate, about 6.5 km from the sea-mouth. As the banks of the estuary are inhabited, the mangrove area is being gradually narrowed. This can be easily observed in the lower regions closer to the sea mouth.

Most of the people are of lower income groups. They depend on fishing and sand mining for their livelihood, while some work in closely located brick and tile factories. Of the fishermen, only a small number fish in the estuary while others fish off the coast. Most workers engaged in the factories are woman

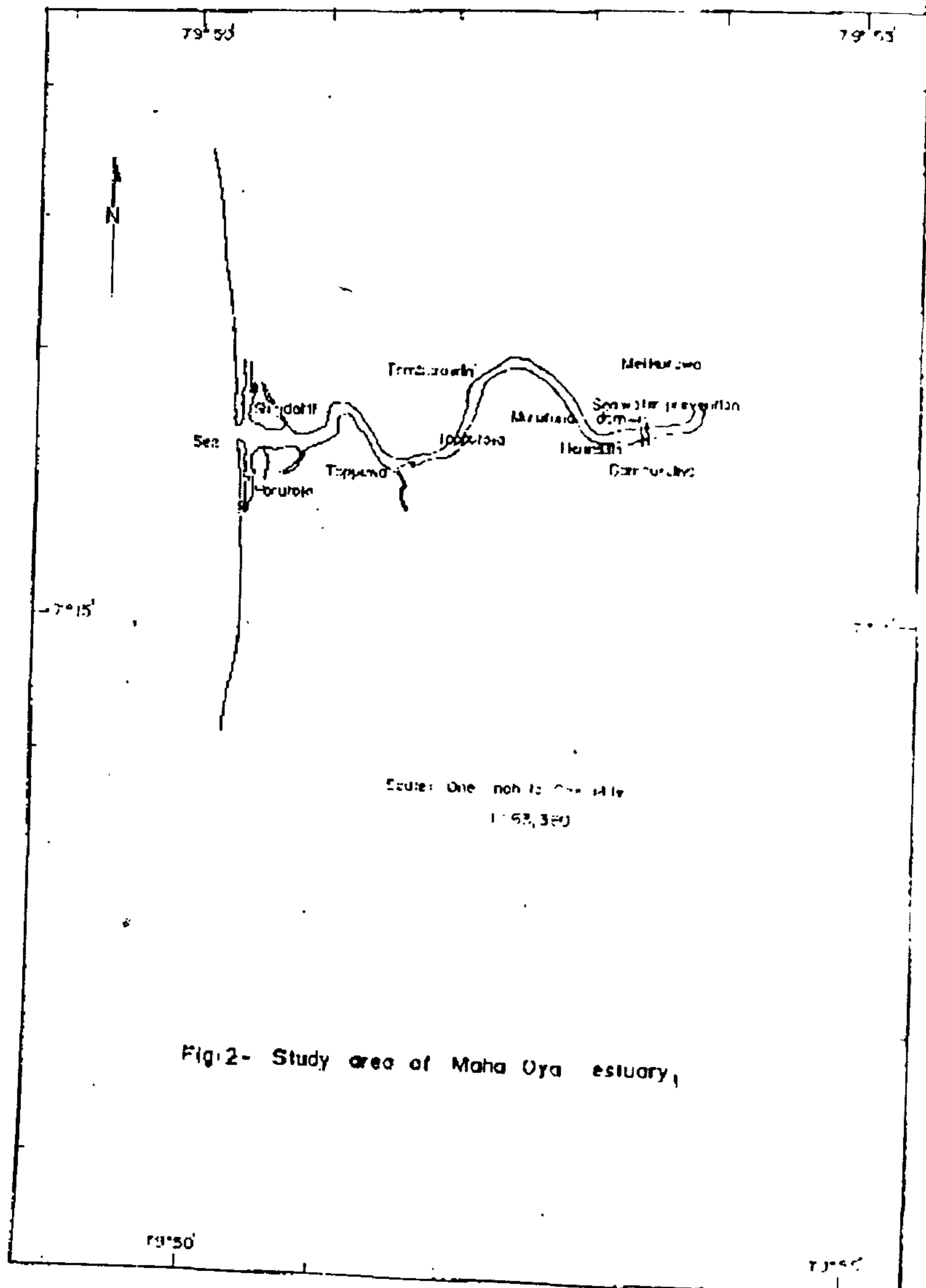
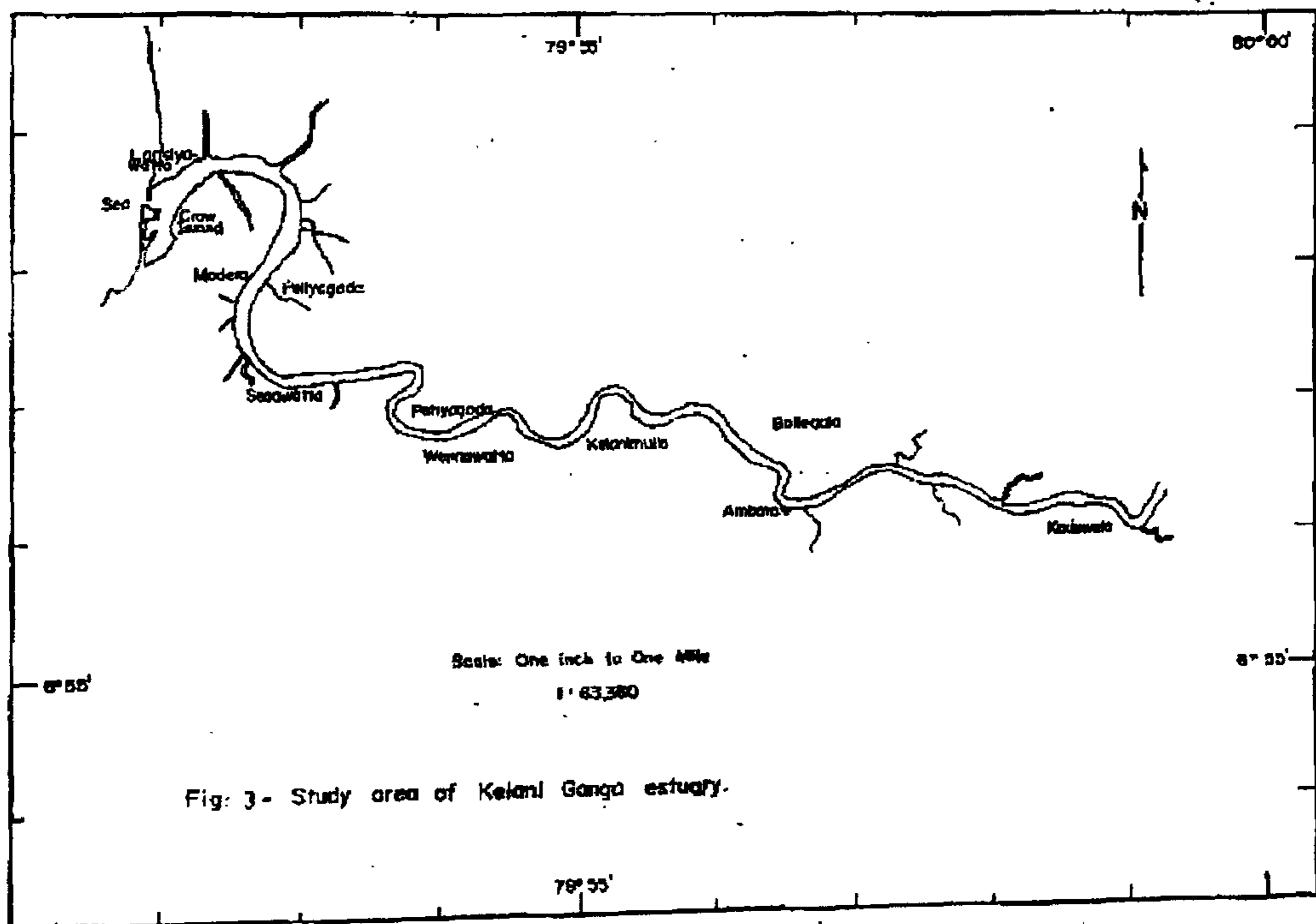


Fig.2- Study area of Maha Oya estuary,

### KEALANI GANGA ESTUARY

Kelani ganga estuary too is located in the wet climatic zone of the west coast bordering the Colombo city (Fig.3). Extent of the estuary is about 11 km from the sea mouth. This is a highly populated and urbanized system due to its close proximity to the city. The river banks in the vicinity of the sea mouth are densely populated reducing the mangrove areas. Most of the inhabitants in this area engage themselves in fishing. There is a fair number of people working in urban areas too residing in this area. However, all these social communities fall into low income groups. Of the fishermen, majority fish off the coast while others engage in traditional lagoon fishery.





## OCCUPATIONAL STRUCTURES DEPENDENT ON THE ESTUARINE SYSTEMS

### *1 Capture Fisheries:*

Capture fisheries play a major role in the Bolgoda/Panadura estuary. About 200-250 fishermen in the area are involved in fishing. In the Maha Oya and Kelani Ganga estuary systems, this is not the major estuary dependent occupation. However, there is a fair number who depend on fishing. In the Maha Oya Estuary the number varies between 25-30 while during monsoons nearly 40-50 coastal fishermen also earn their living by fishing in the estuary. In the Kelani Ganga estuary 25-30 traditional fishermen live on capture fisheries. A fair number (20-30) of coastal fishermen also fish in the estuary during monsoons.

### *Types of gear:*

*Cast nets* - These nets are being used in all three estuaries. Nets are operated during the day time in the shallow areas and near the sea mouth of the estuary for prawns and fish.

*Encircling nets* - Fishermen in the Maha Oya and Bolgoda/Panadura estuaries use this gear. Small meshed (1" - 1 3/4") nets are used to encircle fish in the shallow areas during day and also at night. It was reported that this method is monopolized by few people in the Bolgoda/Panadura estuary (four groups each consisting of four people). There, they set the nets across the fish kraals within the space left for the movements of boats. Two 'onlookers' on either side of the net watch for fish moving towards the net and signal the third person who then lifts it up. The fish vendor is the fourth person who helps in the marketing.

*Gill and trammel nets* - Nets with mesh sizes between 1 1/4" - 2 1/2" are used to catch fish and prawns in all three estuarine systems. Nets are laid close to the sea-mouth in the evening and hauled with the break of dawn.

*Rod and line* - Fishermen carry out rod and line fishery in the shallow areas near the sea mouth in all three systems and this is done mostly for personal consumption. About 15-30 people in each estuary use this gear daily.

*Fish Kraals* - (locally known as Ja-kotu). This is the main type of method applied in the Bolgoda/Panadura estuary. Nearly 40 fish kraals are in operation (Fig. 4). Fish kraals are long screen barriers with 2-9 chambers installed practically right across the waterway leaving space for the passage of boats. Kerosene lamps are lit inside the chambers to attract fish and shellfish species. Harvesting is usually done once a day (at dawn) but occasionally twice.

### *Type of crafts used in capture fisheries:*

Traditional dug-out canoe with a out-rigger is the common craft used in casting nets, setting gill/trammel nets, encircling operations, in rod and line and fish kraal operations. In the recent years fishermen in the Bolgoda/Panadura estuary were given fibre glass 'orus' by the Ministry of Fisheries. Fishermen use these 'orus' in all types of fishing operations mentioned above. There are 181 fibre-glass 'orus' operating in this estuary.

### *Composition of catch:*

Catches generally consist of the fish and prawn species given in table. Fish catches obtained from all the methods mentioned above are composed of a mixture of these species. However, dominant species in the Kelani estuary are mullet-headed goby and estuarine cat-fish.

In the Bolgoda/Panadura estuary, prawns are dominant in the catches. Giant fresh water prawn (*Macrobrachium rosenbergii*) is caught only from Maha Oya estuary. Fishermen of this estuary reported that some years ago, this particular freshwater prawn formed a very high percentage of their catches, but the stocks seem to be diminishing in the recent past mainly as a result of over-exploitation. Over-exploitation, pollution, sand bar formation, which prevents the larvae of various fish and shellfish coming into estuaries from the sea, are common complaints made by fishermen. The catch increases are observed after floods and during the monsoons (March - May, October - November).

Table 1: Composition of catch in the three estuarine systems

Scientific Name	English	Sinhala
<i>Mugil sp</i>	Grey mullet	Godaya
<i>Chanos chanos</i>	Milk fish	Waikkaya
<i>Lates calcarifer</i>	Sea-bass	Moda
<i>Mugilogobius valigouva</i>	Mullet-headed Goby	Valigouva
<i>Oreochromis mossambicus</i>	Tilapia	Japan Korali
<i>Etroplus suratensis</i>	Sanded Etroplus	Korali
<i>Ambasis sp</i>	Glassy perchlet	Katilla
Juveniles of <i>Caranx sp</i>	Carandgid	paraw
<i>Penaeus monodon</i>	Tiger prawn	Kalissa
<i>P.indicus</i>	White prawn	Elissa
<i>Metapenaeus sp</i>	Small prawn	Malissa
<i>Macrobrachium rosenbergii</i>	Giant fresh water prawn	KohilaIssa
<i>Sillago sihama</i>	Silver whiting	DiyaKalanda
<i>Leiognathus sp</i>	Pony fish	Karalla
<i>Tachysurus sp</i>	cat-fish	Anguluva

Some monthly catch data of fibre glass canoes (oru) obtained from the Ministry of Fisheries are given in Table 2. These are catches obtained from different types of fishing.

Table 2: Monthly catch data of fibre glass canoes operated in the Bolgoda/Panadura Estuary (in Kg)

Place	No.of Fibre glass boats	'85 July	'85 Sept.	'85 Oct.	'85 Nov.	'85 Dec.	'86 Jan.	'86 Feb.
Diggala	22-35	1957	2065	2059	2613	3404	2195	2418
Ambalanduwa	23-27	739	1891	2025	2610	3628	2484	1170
Thotawatta	05-08	317	595	674	487	761	637	540
Kindelpitiya	01	50	102	96	123	147	114	90

Average catch per fishermen per day in the Maha Oya, Kelani, Bolgoda/Panadura estuaries varies between 1-5 kg. Catches from the fish kraals in the Bolgoda/Panadura estuary system varies from 1-15 kg. per day.

### **SOCIO ECONOMICS:**

The community which depend on capture fisheries in these systems comprises of a very low income group. An average family consists of 4-8 members. They rarely own any land and live in small dwellings along the banks of the estuaries. Though self-employed, they depend on bicycle-fish vendors to sell their catch. There are times, just after monsoons, when fishermen earn more from catching fish such as carangids, mullets etc. Some days the catches are barely sufficient to meet their own consumption. Average daily income during lean periods are between Rs. 15 to 25/= per fishermen. This increase to Rs. 75/= to Rs.100/= per fishermen during rainy seasons. It is only during the prawn season (March - May, October - November) that the income increases from Rs. 100/= to Rs. 150/= per day per fishermen. Average annual income of a fishermen is Rs. 3,000/= to Rs. 4,000/=.

Generally, the owners of fish kraals at Bolgoda/Panadura estuary are from the middle income group as only they can afford the initial costs (construction cost of a 5-6 chambered fish kraal is around Rs. 10,000/= to Rs.20,000/=). 2-3 families from low income group depend on each fish kraal and 50% of the daily net profit in each kraal is divided among them. Owners earn an annual income of Rs. 8,000/= to Rs.10,000 from each fish kraal. Maximum income is obtained during the prawn season, with an average of about Rs. 800/= to Rs.1000/= per day per fish kraal. Based on the catch data obtained from the owners of fibre glass canoes (issued by the Ministry of Fisheries) each owner earns between Rs. 5,000/= to Rs.6,000/= per annum.

### **11 Sand Mining**

This is the major occupation of the communities of Maha Oya and Kelani Estuarine Systems. During the time of the survey about 90 rafts in the Maha Oya estuary and 60 rafts in the Kelani estuary were in operation. The Department of Coast Conservation has imposed restrictions on sand mining near the sea mouth of Kelani estuary and only 3 rafts were observed near the sea mouth whereas earlier 10-15 rafts were reported to be working in this area. In the up-river about 45 are in operation. The rafts in the Kelani estuary are large in size and employ about 5-10 people on each raft whereas at Maha Oya only 2-3 persons work on a raft.

### **TYPES OF CRAFTS :**

(a) *Wooden rafts* : About 50% of the rafts in the Maha Oya estuary and about 95% in the Kelani estuary are wooden. The complete structure of this type is made out of wood such as Domba, (*Exlophyllum inophyllum*), Jak (*Artocarpus heterophyllus*) and Hora (*Dipterocarpus Zeylanicus*). The cost of construction varies between Rs. 20,000/= to 35,000/=. This type is preferred for its durability and owned by wealthy people in the area. The larger type used in the Kalani estuary has a holding capacity of 5 cubes of sand while the smaller type used in the Maha Oya has a capacity to hold 1.5 to 2 cubes.

(b) *Barrel rafts* : This type is used at Maha Oya estuary. Empty barrels are used as floats with a wooden platform. Cost of construction is about Rs. 3,000/=. About 13% of the rafts used in this estuary are barrel rafts with a holding capacity of 1-2 cubes.

(c) *Bamboo rafts* : Around 31% of the rafts in use in the Maha Oya estuary are made of bamboo. This type is also used (5%) in some places up river in the Kelani estuary. The construction cost is around Rs. 3000/= to 5000/=. Holding capacity is 1-2 cubes. Some rafts are owned by the miners themselves.

(d) *Rafts made out of canoes* : Two dug out canoes are used with a wooden platform. 6% of the rafts used in the Maha Oya estuary are of this type. This type has a holding capacity of 1-2 cubes and the cost of construction is about Rs. 4000/=.



### ***Socio Economics***

Sand mining in Kelani river is more difficult than that of Maha Oya because of the deep waters. Miners use wooden poles as foot holds to dive and work for about 12 hours a day. They are paid on a per load basis. A raft of 5 cubes of sand brings an income of Rs. 700/= to 800/= to the group. The owner makes his profit by selling the sand. Efficiency depends on the number of people involved and the water level of the river. When the levels are low, they manage to mine two raft loads of sand per day (10 cubes) Annual income is in the range of Rs. 3000/= to 5000/= and the period in operation is about 6 months (non-monsoonal period). In the Maha Oya estuary about 75% of the rafts are owned by businessmen. Some of them own 2-3 rafts. Others are operated by the owners. Miners who operate on contract basis or daily paid basis are villagers of the area. Three people work on each raft, two for mining and one to empty the water that gets collected on the platform. This is normally done by a female member of the workers family. This person is paid only Rs. 5 per day. As sand mining is a very hard job people work only during the morning hours. With maximum effort, each raft can mine only 3 cubes of sand per day. Daily paid labourers get Rs. 25/= to 50/= per cube. Those who work on contract basis get 50% of the selling price. Selling prices vary with season and place of mining. Sand mined from shallow areas (eg. sea mouth) fetches Rs. 80/= per cube and sand mined in the deeper areas (eg. up river) fetches upto Rs. 130/= per cube. Annual income of a sand miner ranges from Rs. 3000/= to Rs. 5000/=. Operations can be done only for six months a year (4-5 days a week and no work during the monsoons).

### ***11 Transportation***

Both Kelani and Bolgoda/Panadura estuaries are used for transportation of logs and bamboos from up river and for transportation of people across the river.

#### ***Types of crafts used***

(a)*Bamboo and logs* : Both systems utilize the same method to transport bamboos and logs. They are tied together to make long rafts and 2-3 people manoeuvre these rafts down river using poles. There are 20-25 people involved in unloading bamboos and logs in each area.

(b)*Dug out canoes and ferries* : These two types are used for transportation of people across the river.

#### ***Socio-economics***

Rs.15/= to 20/= is paid per bamboo brought and the price paid for logs depend on the type. Those who unload logs are paid daily (Rs. 40/= to 50/=) per person per day. Rs.50/= to 75/= per 100 numbers of bamboos is paid for unloading. Annual income of the people hardly exceed Rs. 3000/=. Each bamboo is sold at Rs. 30/= to 35/=.

Charges for ferrying people across varies from Rs.1/= to 2/= per person and the ferry-man get paid daily (Rs.50/= per day) and canoes are often operated by their owners.

#### ***vi Other economic uses of the estuarine systems***

*Nursery functions*: These systems serve as a nursery ground and refuge for many species of fish and shell-fish during their life history. (eg. larvae and juveniles of *Penaeus* and *Metapenaeus* prawns, *Etroplus* sp. (pearl-spot), *Mugil* sp. (grey mullet) *Chanos chanos* (milk fish)

*Macrobrachium* sp. (Giant fresh water prawn) *Lates calcarifer* (sea-bass).

*Harbour* : Sea mouths of these estuaries are used as an anchorage for 100-150 sea going fishing boats.

*Domestic uses* : Many laundrymen in Colombo use Kelani estuary for their washing and cleaning purposes. Inhabitants also use these systems for bathing, cleaning and washing.

*Disposal of industrial wastes and sewage* : Factories located along the estuaries discharge their waste products into the estuaries. (Eg. saw dust in the Bolgoda/Panadura estuary, broken tiles, bricks etc. from tile factories along the Maha oya estuary, various chemicals from factories located on the banks of Kelani estuary). In addition inhabitants with very poor sanitary facilities use the estuary as a sewage outlet.

*Reclamation* : Mangrove areas around these estuaries have been reclaimed at a fast pace to build houses, factories etc.

*Water for industrial uses* : Water is taken from the estuaries to meet the requirements of industries (eg. Tile and brick factories).

*Salt water prevention* : In order to overcome the scarcity of freshwater in the Negombo area, the Maha Oya is dammed near Katana and the pumping station is located at this point. A spilt way is built to prevent salt water entering the pumping area.

*Plantation* : In the up-river areas of Kelani and Bolgoda/Panadura estuaries, vegetable cultivation is done on a small scale.

*Recreation* : In the Bolgoda/Panadura estuary, there are several tourist hotels located near the sea mouth (4-5 km radius) and the estuary is used as a recreation center. Wind-surfing, boating and bird watching are some of the activities carried out.

*Aquaculture* : Ministry of Fisheries successfully conducted an experimental pen-culture project in the Bolgoda/Panadura estuary and now four fish pens are constructed by people around the area with the assistance of the Ministry of Fisheries.

## **HUMAN IMPACT ON ESTUARINE SYSTEMS**

*Fishing* - Use of prohibited mesh sizes and fishing gear is evident in Bolgoda estuary. It was reported that the coastal fishermen use a very small meshed encircling net in this system. When this type of mesh sizes are used, destruction of very small larval forms of many fish and crustaceans takes place. Reduced catches are also due to indifference shown to importance of maintaining sustainable yields.

*Sand mining* - Sand mining has brought adverse effects on Maha Oya and Kelani Ganga estuaries. In Kelani estuary, the rate of extraction is estimated to have exceeded the total bed load transported (Samarakoon and Pinto, 1985). This reduces the sediment supplies to the sea that helps beach formation. This also could make erosion of the shore line by which destruction of the mangroves takes place.

*Construction of Barriers* - Barriers such as fish-kraals (eg. in Bolgoda estuary) and dams (eg. salt water preventive dam in Maha Oya) also could hinder the delivery of sediments to the sea. In Bolgoda estuary these fish kraals may be blocking the migratory paths of fishes and shell-fishes.

*Pollution* - Though tolerable quantities of sewage could increase productivity, the rate at which the sewage is disposed to the Kelani Ganga might bring harm to flora and fauna in the estuarine system.

*Other pollutants* (chemicals etc.) discharged, kill fish and shell-fishes in estuaries. Such incidents have been reported from Kelani Ganga and Bolgoda. Fishermen from the northern branch of the Bolgoda estuary reported that their fish fetch very poor prices due to tainted flesh and the smell of kerosene oil.

#### *Other activities*

Further destruction of the limited mangrove areas by using them for dwellings, firewood and timber could bring harmful results such as shore-erosion.

### ***SOME CONSTRAINTS OF THE ESTUARIES DEPENDENT COMMUNITIES.***

Poor living conditions of the estuarine dependent human communities were observed in all three systems. Average income of a family ranges from Rs. 3,000 - 5,000 which is hardly sufficient to meet the present day cost of living. Major estuarine dependent vocations (fishing, sand mining, log/bamboo transportation) depend on season. Log/bamboo transportation and sand mining is totally affected by rains, and fish and shellfish catches are low when the sand bars are formed obstructing fish and shellfish larvae getting into the lagoon from the sea. During these periods, they find it hard to earn their living and are compelled to be indebted. Complaints of poor catches by fishermen were common in all estuaries studied. According to them, upto recent times they had managed very good catches to live fairly comfortably, but now the catches are extremely poor. Industrial pollution, over-fishing, use of prohibited gear could be contributory factors.

### **DISCUSSION**

The duration of the study was two months. From this only 12 days were actually spent to gather information, make observations and obtain basic scientific data on the estuaries, socio-economy of the dependents, human impact on the system. The study therefore is only of a preliminary nature

A more detailed and extended study of the human communities, physical and biological aspects of the estuaries is needed to get an over-all picture of the systems.

Information given in the study was obtained from the estuarine dependants. These should be checked and observed at length, at least for two seasons over a period of one year.

Upliftment and stabilization of the living conditions of human communities is a common problem that should be handled with great care. More studies on the associated family systems are required in this respect. Rehabilitation of fish and shellfish stocks of the respective estuaries is another aspect that needs attention. Certain fishing gear are prohibited in the estuaries. Nevertheless prohibited gear is used in these systems. (eg. in Bolgoda, coastal fishermen use small-mesh encircling nets, locally known as karapala del.). Therefore, rules and regulations imposed on fishing activities need careful consideration and revision and the authorities responsible must closely study the effectiveness of the imposed regulations. Pollution studies also need priority. Especially areas like Kospalana in Bolgoda/Panadura estuary needs attention. Formulation of rules based on such studies will be useful for the fisheries. Population studies of the important fish and shellfish are essential to control over-fishing. Introduction of different Aquaculture methods and releasing of hatchery-bred fingerlings to the system may also help the replenishment of fisheries.

**REFERENCES**

MACNAC W. (1974).

A general account of the fauna and flora of mangrove swamps and forests in the Indo-West Pacific Region. *Adv. Mar. Biol.*, **16**:72-270.

MARTOSUBROTO, P. and NAAMIN, N. (1977).

Relationship between tidal forests (mangroves) and commercial shrimp production in Indonesia. *Marine Research in Indonesia*, **18** : 81-86.

ODUM, W.E. (1971).

Pathways of energy flow in South Florida estuary *Sea Grant Tech. Bull, University of Miami*, **7** : 162.

SAMARAKOOM, J.I. and PINTO, L. (1985)

Synthesis Report for Information on critical habitats in the coastal zone. Workshop on critical habitats in the coastal Zone *CCD/USAID/URI Technical Report* : 16