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THE BIOLOGY OF THE GENUS *MACROBRACHIUM* (DECAPODA: CARIDEA: PALAEMONIDAE) IN THE ST. LUCIA SYSTEM

PROGRESS REPORT: DECEMBER 1977

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ABSTRACT

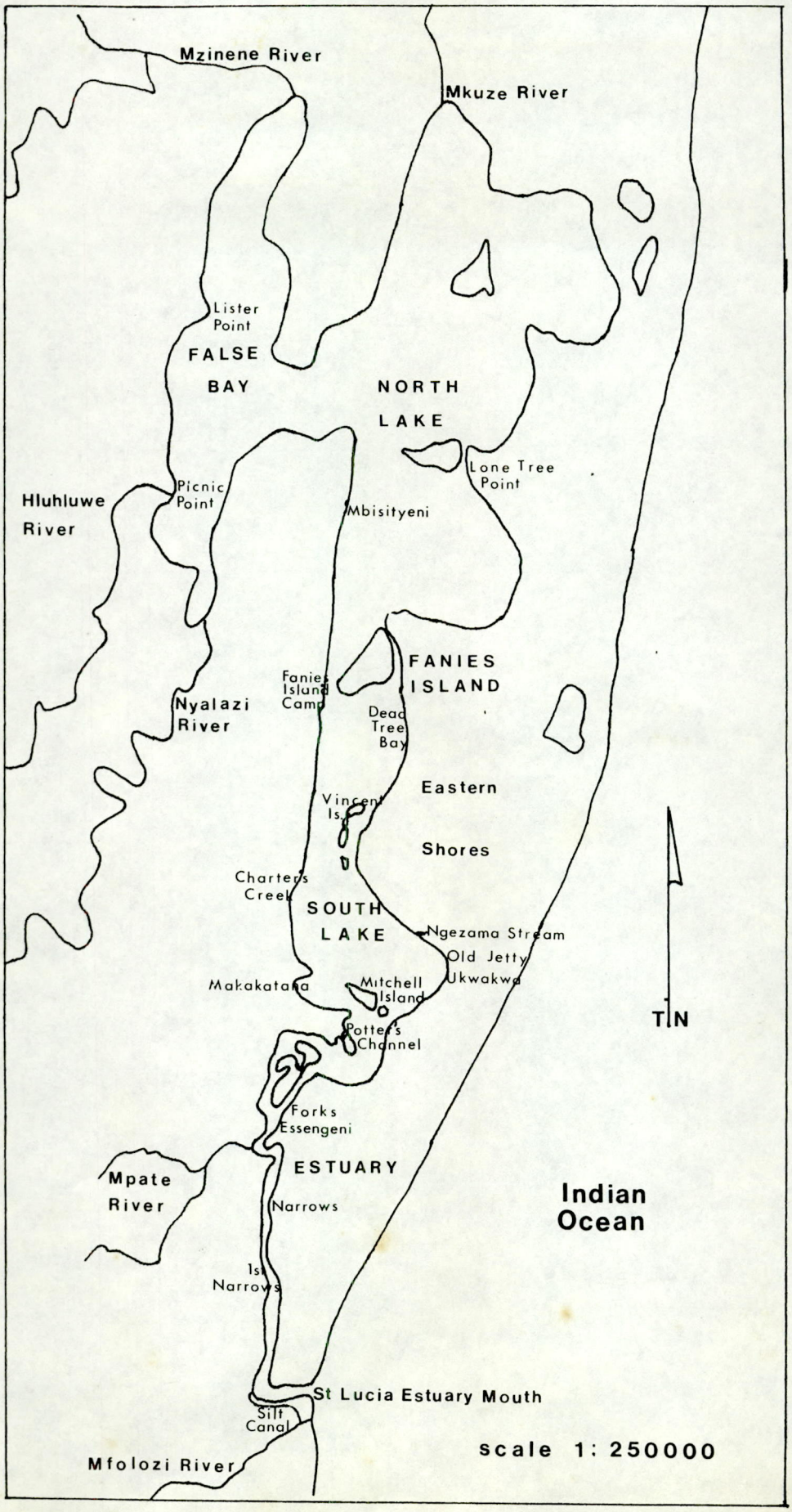
Present knowledge indicates that the St. Lucia system is a major area for *Macrobrachium equidens* on the Natal coast. The N.P.B. bait fishery has shown that this species at times makes a significant contribution to the penaeid based fishery. A trapping program in the Narrows and the lake area of the system has shown that there are marked fluctuations in abundance and distribution in the system. These variations appear to be related partly to salinity changes although the significance of other environmental factors such as substrate, wave action and vegetation remains to be clarified.

The report describes the inadequacies in the present sampling system and an improved and modified program for 1978 is outlined.

INTRODUCTION

Previous progress reports (Forbes 1976, Bickerton 1977) described the preliminary investigations into the status of the genus *Macrobrachium* in the St. Lucia system and demonstrated the feasibility of such a study. During 1977 the sampling program was maintained and extended in an attempt to monitor the distribution and relative abundance of the genus in the system and assess the significance of physical conditions in the environment and also to establish basic population data such as breeding season, recruitment and growth.

Fig. 1 : The St. Lucia System.



MATERIALS AND METHODS

(1) Sampling Stations. Following the preliminary survey in December 1976 - January 1977 (Bickerton 1977) sampling was done in April, June, July, September and November 1977. (Samples collected during November have not yet been processed.) The areas sampled are listed in Table 1 and their positions in the system shown in Fig. 1.

Table 1: Areas sampled in the St. Lucia system.

System Component	Locality
Estuary	Lower estuary, silt canal.
"	First Narrows.
"	Essengeni, Narrows.
"	1km south of Potter's Channel water level recorder.
"	Potter's Channel.
South Lake	Makakatana Bay.
"	Ukwakwa.
"	Ngezama Stream.
"	Charter's Creek, N.P.B. Jetty.
"	Vincent Islands.
"	Potamogeton Bay, 2km south of Fanies Island Camp.
"	Dead Tree Bay.
Fanies Island	Fanies Island Channel.
North Lake	Mbisityeni, The Coves.
False Bay	Picnic Point, Hluhluwe River Mouth.
"	Lister Point.

The northern and north-eastern areas have not been investigated for logistical reasons (available time, fuel costs). Results to date suggest that populations would be negligible in these areas.

Salinity records for the system were obtained from Mr. F. Joubert of the Natal Parks Board and at each station additional notes were made on salinity, maximum and minimum temperatures during the sampling period, substrate type and amount of vegetation.

(2) Sampling Techniques. Prawns were collected using specially designed traps. These consisted of wire mesh cylinders (50cm long, 20cm diameter) with an entrance funnel at each end. An entrance trap door was cut through the mesh and the traps baited with fish, usually Mugil spp. Each trap was connected to a marker float consisting of a 2 li plastic bottle filled with freon blown polyurethane. This procedure made the floats virtually crocodile proof and no traps were lost after this procedure was adopted.

Initial laying of traps parallel to the shore in the marginal vegetation and also at right angles to the shore indicated that Macrobrachium is largely restricted to the shore line and trapping was subsequently confined to the littoral areas. Initial observations also showed that catches were better at night and all subsequent trapping was carried out overnight.

Distance and time did not permit all stations to be sampled during each survey. Seven or eight stations per survey were selected to give an indication of the distribution of Macrobrachium in the system and at the same time ensure a catch large enough for population structure analysis.

When possible 200 prawns were collected at the beginning of each month from the N.P.B. bait fishery or from samples collected by Mr. F. Joubert during penaeid prawn surveys.

All specimens were measured (carapace length), sexed and ovigerous females noted. The length of the large chelipeds was recorded. Prawns were classified into 1mm carapace length size classes. Ash-free dry weights of five males, females and ovigerous females in each size were determined.

RESULTS

Species present in the system. Forbes (1976) identified the species present in the system as *M. equidens* following Kensley (1972). This more extensive survey produced a second species thus far identified as *M. scabriculum*. This species appears to be restricted to lower salinities than *M. equidens* and is more dependent on the presence of vegetation. It is however present in relatively small numbers and the rest of this report will refer only to *M. equidens*.

Morphology of *M. equidens*. The most striking feature of this species and the genus as a whole is the development of the chelipeds. The relation between carapace length and cheliped length in the females is linear but curvi-linear in the male where there is marked allometric growth of these limbs beyond a carapace length of about 18 mm. (Fig. 2). Preliminary observations show that they are used for feeding but in addition appear to have a courtship significance in the males.

Distribution of *M. equidens* in the St. Lucia system. During the December 1976 - January 1977 survey *M. equidens* was recorded in the upper section of the Narrows, the east and west shores of South Lake and as far north as Lone True Point. In April *M. equidens* occurred in South Lake and in the estuary (bait fishery sample). By June and July *M. equidens* had disappeared from South Lake although it was still present in the estuary. In September *M. equidens* re-appeared in South Lake and was still present in the estuary.

The major physical feature which fluctuated during this period and appeared likely to have affected distribution was salinity. During December 1976 - January 1977 salanities ranged from 4-34‰ in the sampling areas and were high in the lake (4-14‰). Following rain in February salinities declined throughout the system and conditions were essentially fresh from April until June. By July salinities had recovered in the estuary (20‰) but the lake was still fresh (2‰). Salinities in the lake began to rise at the end of August and have since been increasing steadily. There is thus a correlation between the extended period of low salinities in the lake and the disappearance of *M. equidens*. This was followed by an increase in salinities and the

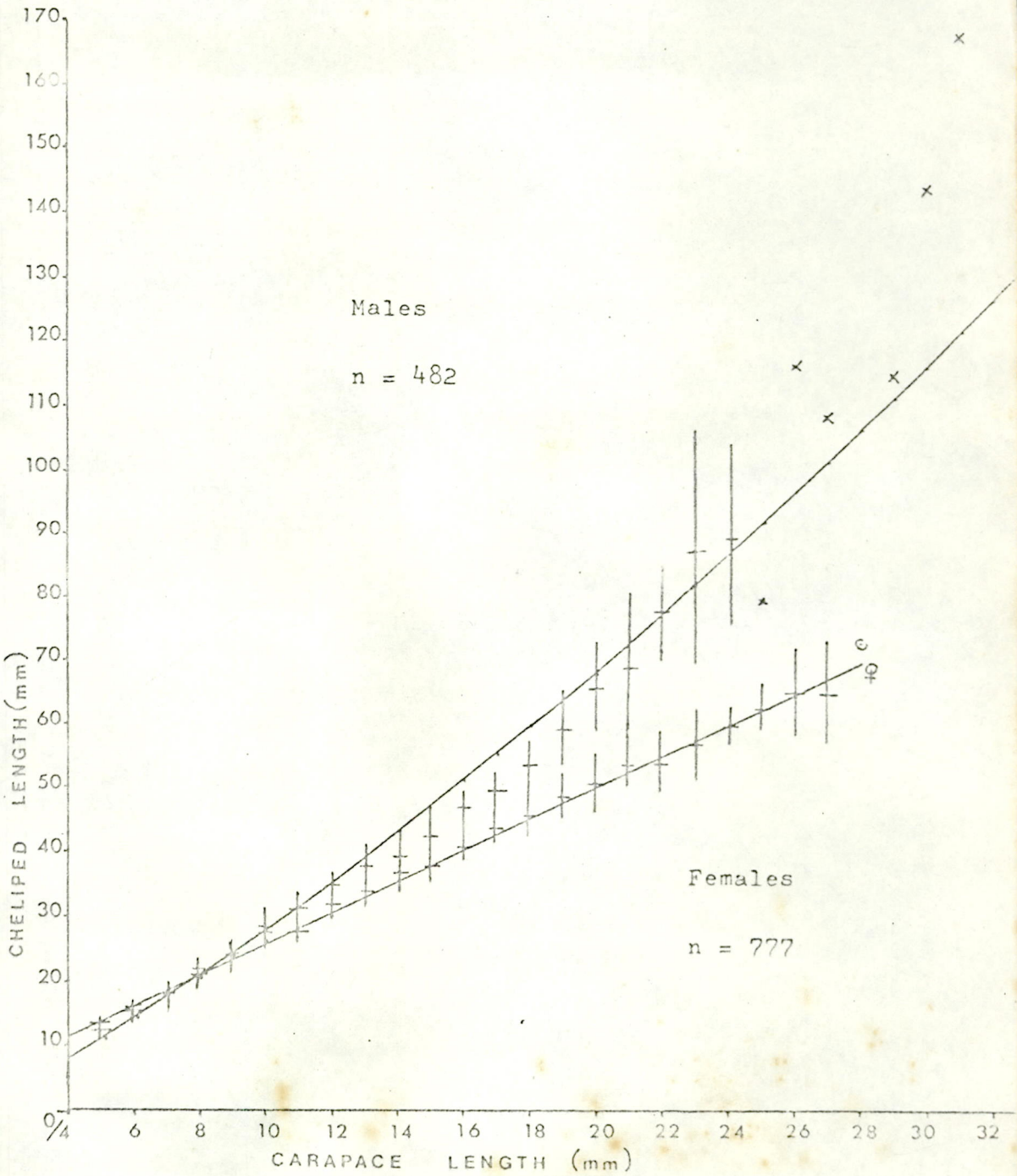


Fig. 2: Carapace length/cheliped length relationships in male and female M. equidens. Horizontal lines are means. Vertical lines are standard deviations. X males and O females are means where sample size was too small to calculate standard deviations.

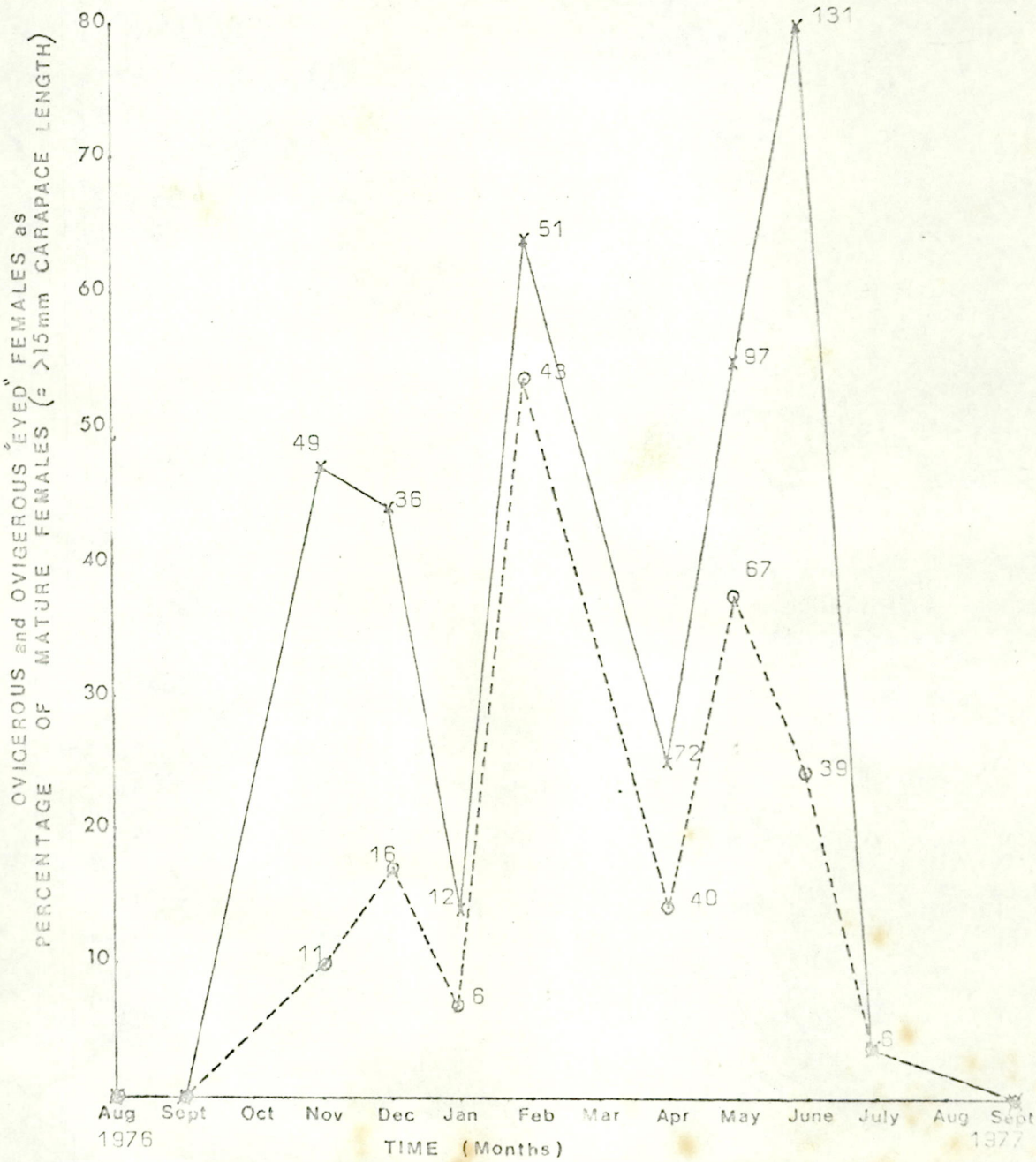


Fig. 3: Breeding of M. equidens in the St. Lucia system during 1976 and 1977. Crosses and solid lines represent percentage ovigerous mature females and circles and dashed lines the percentage of ovigerous females with "eyed" eggs. Figures indicate actual numbers of ovigerous females and females with "eyed" eggs.

re-invasion of South Lake. Results to date thus indicate a nucleus population in the upper regions of the Narrows which shows periodic pulses into the lake areas. Factors limiting downstream distribution are uncertain at present.

There are other differences between the environment in the Narrows and the lake e.g. areas of permanent inundated vegetation and reduced wave action but further investigation would be required to clarify the significance of these factors. There appears to be a tendency in the lake for more prawns to be present in areas of submerged vegetation but this was not so noticeable in the Narrows where good catches were recorded from open shores.

Breeding and growth. Results from the bait fishery and the trapping program during 1976 and 1977 indicate an extended breeding season from November to July (Fig. 3) with clear peaks in the numbers of ovigerous females. Ovigerous females were recorded both in the Narrows and the lake at salinities down to 2% . It is unknown whether the larvae would develop successfully at such low salinities.

No information is available on growth rates. The samples from the bait fishery are biassed as the mesh size selectively retains larger prawns and the trapping program has not been sufficiently long nor intensive to provide the information required.

DISCUSSION

The program to date has demonstrated the feasibility of a study of Macrobrachium spp. in the St. Lucia system and also the effectiveness of the trapping technique used; up to 250 prawns have been caught during one overnight period.

There are clear fluctuations in both the distribution and abundance of M. equidens in the St. Lucia system. These fluctuations appear to be at least partly associated with salinity and as this system is notoriously subject to salinity variations further monitoring would help to assess the significance of this factor in the distribution of M. equidens. Further and more intensive sampling would also give more information on the growth and breeding of the species.

There are two major questions arising from the sampling program at present. The efficiency of the traps is unknown, i.e. what is the relation between trap catch and the prawn population in a particular area? The extent of migration of M. equidens in the system is also unknown, i.e. is there migration by the post-larval stages into areas that become suitable or is this invasion accomplished by the planktonic larval stages. Larval salinity and temperature requirements are unknown.

Preliminary mark-recapture experiments using a clipping technique have been successful and these indicate that population estimates could be made. Data on the carapace length/dry weight ratio already exist and could be used for estimates of biomass which are vital for any energetics analyses. Investigation of migration would require the development of more permanent marking techniques and also the use of planktonic sampling to investigate larval dispersal.

REFERENCES

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Proposed Program for *Macrobrachium* spp. Research Project during 1978.

(1) Maintenance of the existing trapping program to monitor fluctuations in distribution. Extension of the trapping program to a monthly basis in selected areas to provide more data on growth and breeding.

(2) Development of mark-recapture techniques on a short term basis to allow assessment of the relation between trap-catch and population density and ultimately between trap-catch and biomass. Development of a longer term marking technique to investigate migration of post-larval stages.

(3) Plankton sampling to check for the presence of the larval stages in different salinities.

(4) Analysis of gut contents of both *M. equidens* and carnivorous fish to establish more clearly the position of *M. equidens* in the St. Lucia food-web.

BUDGET FOR 1978

Bimonthly sampling trips to monitor distribution in the system: Vehicle and boat fuel costs. (Jan., Mar., May, July, Sept., Nov.)	R60.00 x 6	R360.00
Bimonthly samples to complete analysis of population structure changes. Vehicle fuel costs. (Feb., April, June, Aug., Oct., Dec.)	R35 x 6	R210.00
Boat and engine maintenance.		R100.00
Miscellaneous equipment: Wire mesh, lines, plastic bags, spare floats, etc.		R100.00
		R770.00

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