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Author WHITFIELD A K

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666

AN INVESTIGATION OF THE FAMILY MUGILIDAE IN
LAKE ST. LUCIA, ZULULAND, WITH SPECIAL REFERENCE
TO PREDATION AND POPULATION DENSITIES

A.K. Whitfield
University of Natal

PROGRESS REPORTAN INVESTIGATION OF THE FAMILY MUGILIDAE IN
LAKE ST. LUCIA, ZULULAND, WITH SPECIAL REFERENCE
TO PREDATION AND POPULATION DENSITIES.A.K. WHITFIELDZOOLOGY DEPARTMENT, UNIVERSITY OF NATAL, PIETERMARITZBURGIntroduction

Lake St. Lucia, the largest estuarine system in southern Africa is utilized by tropical, sub-tropical and temperate species of grey mullet (Mugilidae). Eleven species, the highest recorded species diversity for a South African estuary, occur within the lake system, including one species which is unique to the area. However, the population densities do not compare favourably with those of other South African estuaries, (Table 1), although in terms of absolute numbers Lake St. Lucia has a numerically more abundant population because of its larger area.

TABLE 1

Mullet as a percentage of the total catch (n)

<u>Locality</u>	<u>% Mugilidae</u>	<u>n</u>
Msikaba Estuary	83,26	231
Umgeni Estuary	81,17	341
Sordwana Estuary	80,00	200
Impenjati Estuary	79,16	48
Kosi Estuary	74,00	804
St. Lucia lakes	18,22	8658

(Blaber, pers. comm.)

Sampling Procedure

Monthly sampling of mullet from Lake St. Lucia commenced in March 1975. Because of the large area involved, research effort was concentrated on South Lake and False Bay. Six seining and two gill netting sites were established and monitored to provide information on relative densities, distribution and movements of the various mullet species. Assessment of natural predation was determined by examining the gut contents of all piscivorous fish captured. An otolith key was developed to aid in the identification of fish remains from piscivores. Human predation in the form of illegal gill netting was monitored in co-operation with Natal Parks Board field staff.

Results and Discussion

(a) Population structure, densities and movements.

A breakdown of the species composition indicates that Mugil cephalus, Liza macrolipis and Liza dumerili are the most abundant mullet species in Lake St. Lucia (Table 2). Valamugil robustus and V. cunnesius are present in most parts of the lake, whereas V. seheli, V. buchanani, Liza tricuspidens, L. alata and Myxus capensis may be considered rare, especially in False Bay. L. alata for example is restricted mainly to areas where streams flow into the lake. The reason for this is because their food is associated with the sand particle size normally found in such areas, (Blaber, 1975).

There is a reduction in the number of mullet species between South Lake and False Bay, (Fig. 1). The reasons for this fall in species diversity towards False Bay are obscure but may be related to salinity, distance from the sea or food.

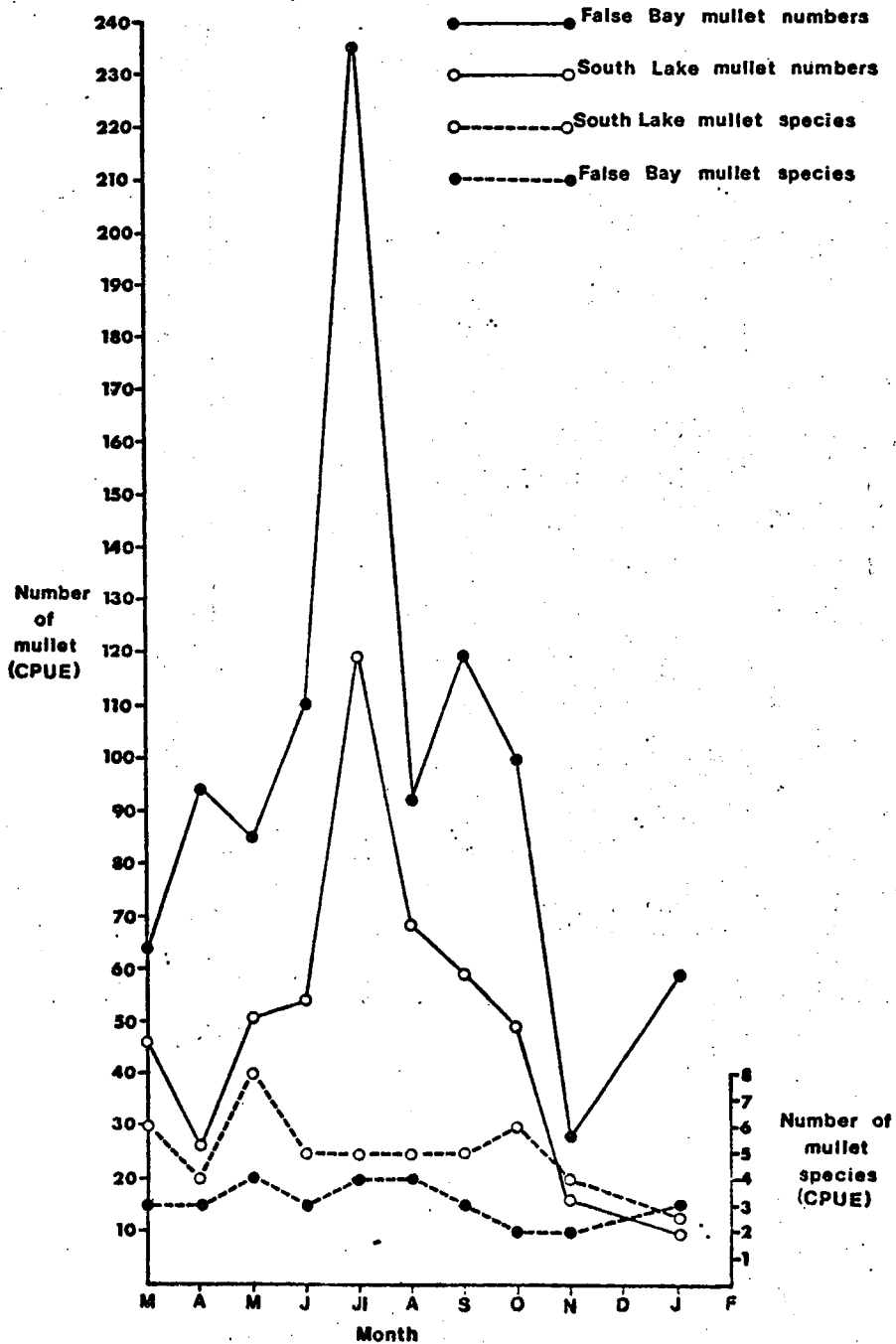
Quantitative data indicates that there are approximately twice as many mullet in False Bay compared to South Lake, (Fig. 1), despite the lower species diversity in the former area. A possible explanation for this phenomenon could be that nutrient inflow from the Nyalazi, Hluhluwe and Mzinene rivers result in a more abundant food resource when compared to South Lake, which receives no major river systems.

TABLE 2

Relative densities (CPUE) of mullet species in Lake St. Lucia

SPECIES	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	JANUARY	n	%
<u>Mugil cephalus</u>	35	41	63	76	132	111	98	116	31	68	771	51,60
<u>Liza macrolepis</u>	25	55	24	14	161	32	7	7	10	2	337	22,56
<u>Liza dumerili</u>	38	21	25	59	52	11	70	4	3		283	18,94
<u>Valamugil robustus</u>			11	9			1	1	1		23	1,54
<u>Valamugil cunnesius</u>	9		5		3	1	3			2	23	1,54
<u>Liza alata</u>		2	1	2	1	1		13			20	1,34
<u>Valamugil buchanani</u>	1				5	3		8			17	1,14
<u>Valamugil seheli</u>	2		6	9							17	1,14
<u>Liza tricuspidens</u>			1			1					2	0,13
<u>Myxus capensis</u>		1									1	0,07
Total	170	120	136	169	354	160	179	149	45	72	1494	100

FIGURE 1. RELATIVE DENSITIES AND SPECIES DIVERSITY OF MUGILIDAE IN LAKE ST. LUCIA.



Altogether 1,584 mullet have been marked; 497 have been tagged and 1,087 fin-clipped. There have been no tag recoveries as yet, but two juvenile mullet (Liza macrolepis and L. dumerili) fin-clipped in South Lake were recaptured in False Bay several months later. These results may indicate a northward movement of juvenile mullet up the St. Lucia Lake system because no individuals fin-clipped in False Bay have as yet been recovered in South Lake.

(b) Fish Predation.

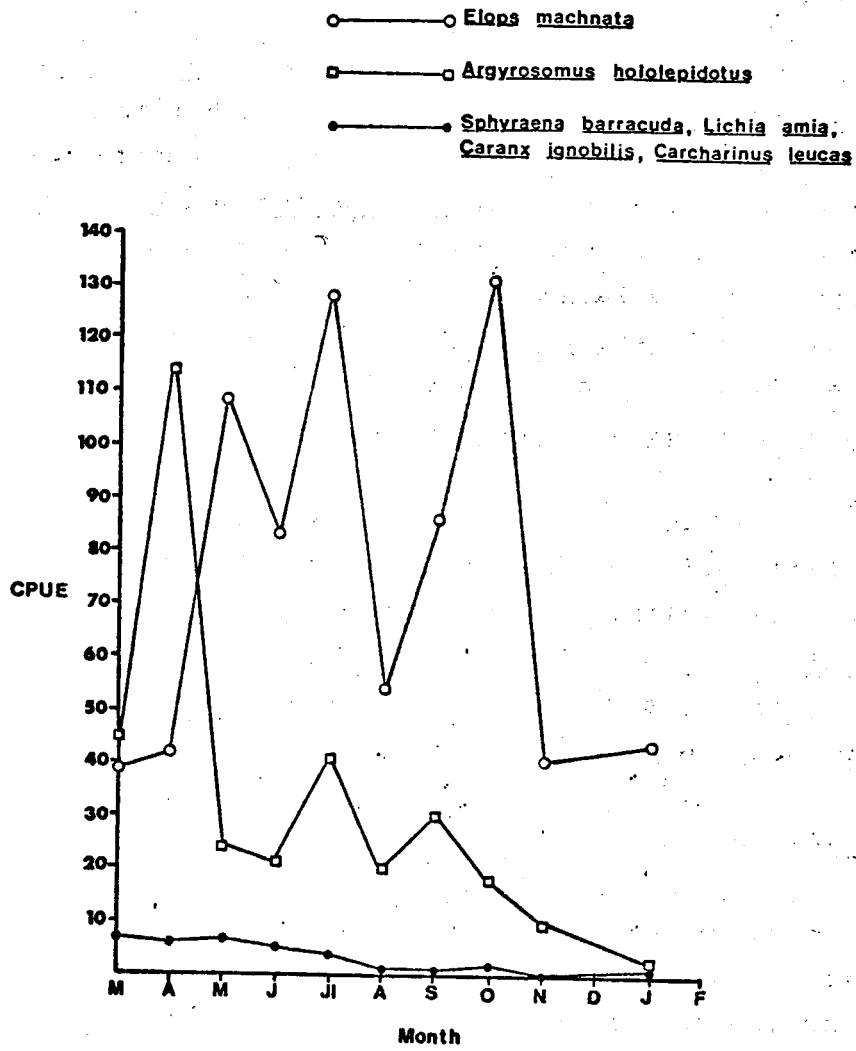
The two most abundant fish predators are Argyrosomus hololepidotus and Elops machnata (Fig. 2). Neither is feeding on mullet to any significant extent, (Table 3), despite the fact that the optimum length classes of M. cephalus and L. macrolepis juveniles are available to these predators (Figs 3 & 4). L. dumerili appear to be larger than the preferred prey size of E. machnata and A. hololepidotus (Fig. 5). The dominant prey species of the above predatory fish are Thryssa vitrirostris, Gilchristella aestuarius and Hyporhamphus knysnaensis.

It would appear that the predatory fish catch sluggish prey more readily than faster moving mullet. The predators most capable of catching mullet: Sphyraena barracuda, Lichia amia, Caranx ignobilis and Carcharinus leucas are present in such small numbers (Fig. 2) that any predator pressure exerted by them would probably be minimal.

(c) Human Predation

Several poachers nets have been examined in detail and all the mullet present were adult Mugil cephalus. The effect of illegal gill netting on the juveniles of all ten mullet species inhabiting the lake is negligible due to the large mesh size of the nets used (50 - 60 mm bar).

FIGURE 2. RELATIVE DENSITIES OF PISCIVOROUS FISH PREDATORS IN LAKE ST. LUCIA.



-7-

TABLE 3

Frequency of occurrence of mullet in the diet of
fish predators in Lake St. Lucia.

(n = number of gut contents examined).

Group 1.

<u>Predator</u>	<u>Common Name</u>	<u>% F</u>	<u>n</u>
<u>Sphyræna barracuda</u>	Sea Pike	100,00	1
<u>Carcharinus leucas</u>	Zambezi Shark	40,47	99*
<u>Lichia amia</u>	Garrick	25,00	8
<u>Caranx ignobilis</u>	Kingfish	11,11	9
<u>Tylosurus leiurus</u>	Garfish	4,76	21

Group 2.

<u>Predator</u>	<u>Common Name</u>	<u>% F</u>	<u>n</u>
<u>Argyrosomus hololepidotus</u>	Salmon	1,05	190
<u>Elops machnata</u>	Springer	0,75	265
<u>Otolithes ruber</u>	Snapper Salmon	0,00	7
<u>Clarias gariepinus</u>	Barbel	0,00	6
<u>Platycephalus indicus</u>	Flathead	0,00	6
<u>Muraenesox bagio</u>	Pike Conger	0,00	4

* Data from Bass, D'Aubrey & Kistnasamy (1973).

FIGURE 3. LENGTH FREQUENCY DISTRIBUTION OF JUVENILE MUGIL CEPHALUS IN LAKE ST. LUCIA. THE PREFERRED PREY SIZE OF THE TWO MOST ABUNDANT PISCIVOROUS FISH PREDATORS ARE SHOWN.

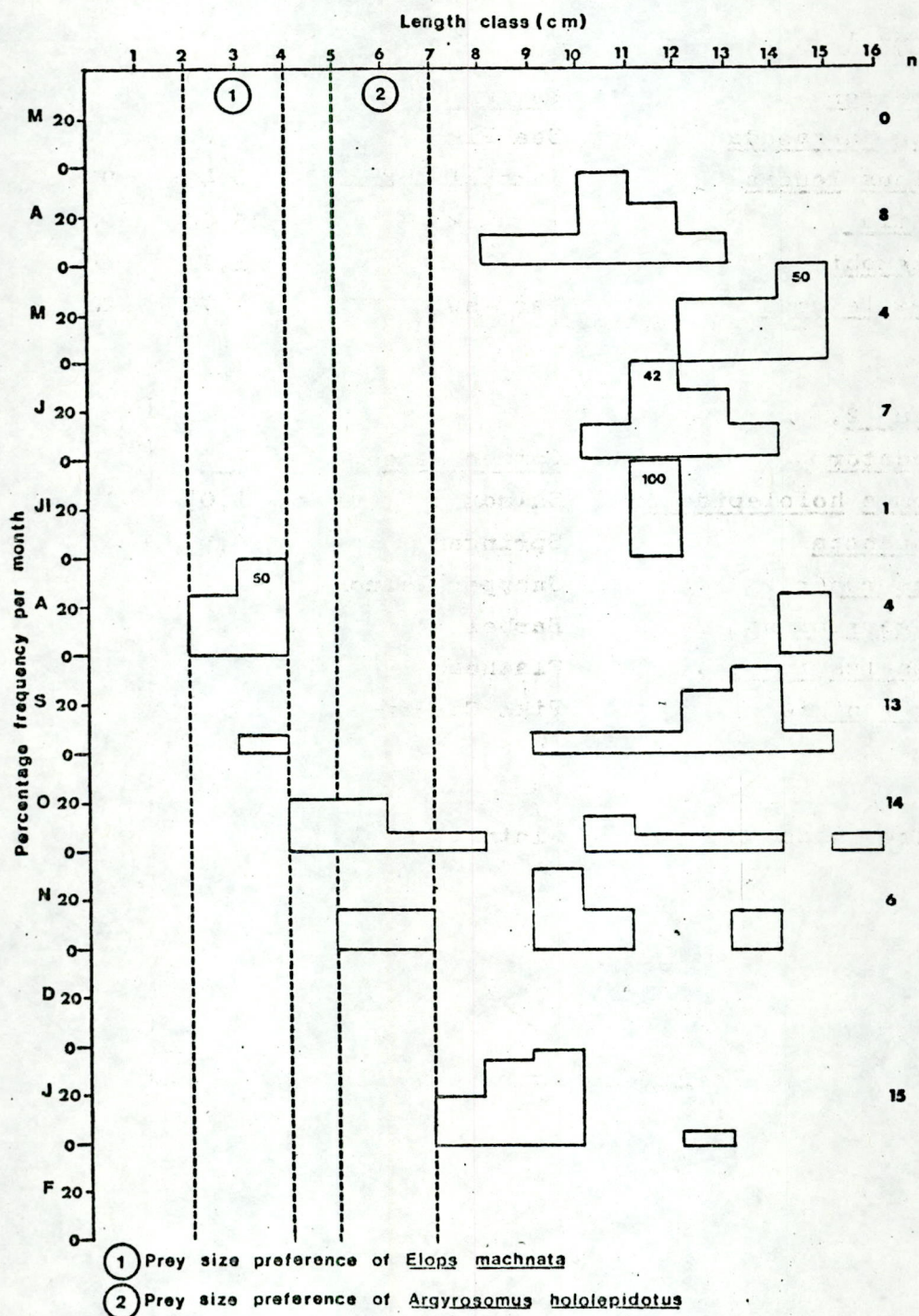
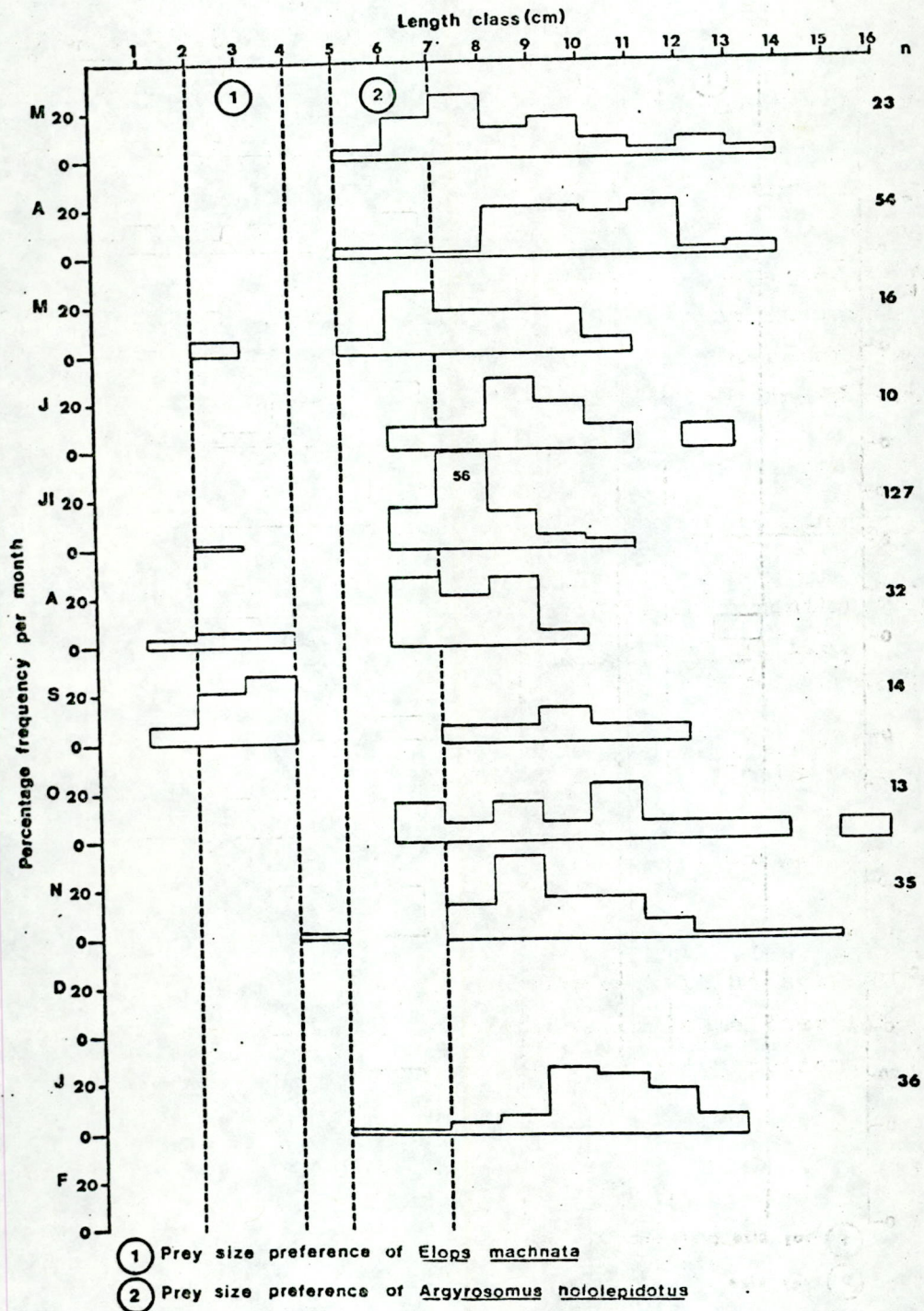


FIGURE 4. LENGTH FREQUENCY DISTRIBUTION OF JUVENILE LIZA MACROLEPIS IN LAKE ST. LUCIA. THE PREFERRED PREY SIZE OF THE TWO MOST ABUNDANT PISCIVOROUS FISH PREDATORS ARE SHOWN.



-11-

In addition the absence of poaching activities in South Lake where the rarer mullet species occur means that the majority of the mullet species in Lake St. Lucia are not adversely affected by illegal gill netting.

Mugil cephalus is however the most abundant mullet species in the lake and the density of this fish is highest in the areas where poachers are most active, i.e. False Bay and North Lake. Also the size range most susceptible to capture by poachers' nets lies between 440 mm and 640 mm. Thus poaching activities are reducing the size of the breeding population before spawning in April and May, (Fig. 6). It also appears that the gear selectivity of the poachers nets coincides with the prey size favoured by the fish eagle (Fig. 6). Illegal gill netting may therefore be regarded as detrimental to the mullet populations and perhaps fish eagle population of the lake.

Management recommendations and conclusions (up to January 1976)

- (1) Intensive anti-poaching patrols in the four months prior to the spawning migration of Mugil cephalus, i.e. between January and April.
- (2) Natural fish predation on mullet is low. It is therefore highly unlikely that fluctuations in mullet numbers due to illegal gill netting will have any effect on the angling fish in the lake, e.g. Salmon and Springer.
- (3) Bird and crocodile predation results will be available early in 1977. Preliminary observations indicate that fish eagles, crocodiles and poachers are in direct competition.

FIGURE 6. LENGTH FREQUENCY DISTRIBUTION OF MUGIL CEPHALUS RECOVERED FROM ILLEGAL GILL NETS IN LAKE ST. LUCIA DURING 1975. VERTICAL ARROWS INDICATE RECORDED LENGTHS TAKEN BY FISH EAGLES (TO DATE).

