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Author BOLTT. R.E.

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Progress Report: St Lucia Benthos Survey

by

R.E. Boltt (1973)

Introduction

A survey was carried out on the benthos of the St Lucia lakes in January 1972, using a van Veen grab sampler. 45 stations were sampled, the positions of which are shown in Fig. 1.

Method.

Samples of 0,0225 m^2 surface area were taken with a hand operated van Veen grab. The samples were washed by decantation through a fine plankton net sieve (Boltt 1969). The collected residues were preserved in formalin in ½ lb consul jars and returned for analysis in the laboratory. The washed samples were first inspected in a flat container for larger animals which were hand picked out and identified. The shell fragments were digested in dilute ($\pm$ 10%) Nitric acid for about 5 minutes, and the samples were then rewashed and scanned under a binocular microscope for removal of further animal material. In some samples with high debris loads, flotation and saturated $mgSO_4$ was used to aid the sorting of the material.

The number and identification of animals was recorded, and the material was then grouped into the rough categories of Worms, Molluscs, Arthropods. Each portion was air dried at 60°C in previously tared aluminium pans. The samples were weighed to the nearest 0.001 mg on a Cahn Microgram Electrobalance.

Results

Natal Parks Board carry out regular salinity tests on the water at various stations on the lake. It was therefore decided that only a few samples would be required to show the salinities at the time of sampling for the Benthic Survey. The results are given in Table 1. In common with the surveys of Day, Millard & Broekhuysen (1954) and Millard & Broekhuysen (1970), the benthic faunal results show that the lake region of St Lucia may be divided into three major areas; False Bay, North lake, North of Fanies Island and South Lake (Table 2).

False Bay. The most sterile area is False Bay where only three samples contained any life (Table 2). The numbers of Chironomid larvae caught were so low as to be insignificant, and it is not wise to multiply the results to give them in numbers or weights/m^2 since this

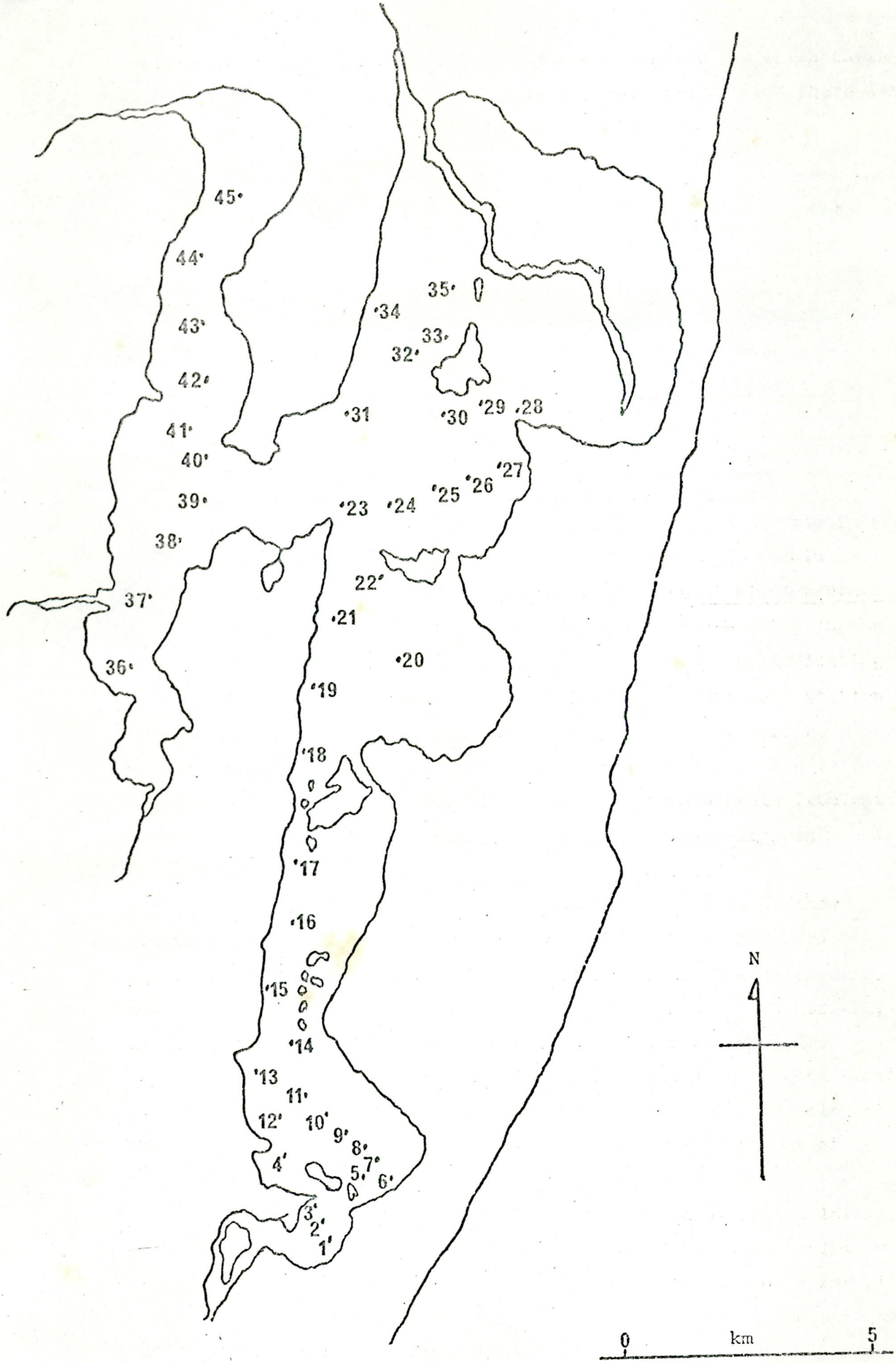

Figure 1. Sketch map with positions and numbering of Stations in St Lucia, taken in January 1972.

would undoubtedly introduce too optimistic a result, for which there is little evidence. It is nevertheless surprising to find these larvae living in such high salinities.

Table 1

Salinity samples from Lake St Lucia - January 1972

Region	St. No.	M. equ. Cl	Salinity
South Lake	11	872	55°/oo
" "	17	1040	80°/oo
North Lake	23	980	62°/oo
" "	35	984	62°/oo
False Bay	45	1208	80°/oo

North Lake. The most consistently abundant animals in the northern regions above Fanies Island were the Ostrocods (Table 2). The sporadic occurrence of the Glycerid polychaete Glycinde capensis Day, and the small gastropod Assiminea bifasciata as high up in the system as Station 26 and Station 27 is very interesting, indicating a salinity tolerance not before recorded for these species. Station 18 appears to be a special case of overflow of animals more to be expected in the south basin, and may reflect a less severely affected salinity regime. It may be that these outliers could form a basis from which repopulation of North lake might take place when salinity regimes return to more normal values.

The total biomass from the samples in North lake show consistently low figures, with a mean of 3.54 ± 6.54 mg/0.0225 m^2. The large standard deviation is a reflection of the uneven coverage of the bottom with animal life. When the two samples with relatively large weights are removed from the list, the mean drops to 1.27 ± 1.11 mg/0.0225 m^2. This may be a more realistic figure since samples 18 and 19 appear to group more naturally with South lake samples for the reasons previously given. This gives an average weight of 0.056 gms/m^2, which is a very low figure.

South Lake. From the region just north of Fanies Island to the south, the diversity of animal life increases with a maximum of 10 different types in Stations 1 and 13, and an average of 6 for all South Bay Stations (Table 2). The corresponding North Lake situation is one station (St. 8) with 8 species, 2 stations with 4 species (St. 19 and St. 32) and the rest with either one or two. In the South Lake samples there is no correlation with respect to diversity and the distance from the channel at the southern end of South Lake.

Table 7.

Data collected by van Veen grab of 0.0225 m^2 from St Lucia - January 1972

	Station No.	Assiminea bifasciata	Solen corneus	Nassarius kraussiana	Tellina sp.	Pittaria kochii	Littorina scabra	Macoma sp.	Nemertina worms	Prionospio sp.	Glycinde capensis*	Capitella sp.	Apseudes digitalis	Grandidierella sp.	Harpacticoid copepoda	Cumacea	Ostracoda	Gomphid dragonfly nymph*	Chironomid larvae	Nematoda	Unidentified polychaetes (Juves)	Cleistosoma edwardsii*	Total weight mg/0.0225 m^2
SOUTH LAKE	1	26	3	-	-	-	-	1	-	7	3	-	1	-	-	-	-	-	1	681	10	-	6,232
	2	37	1	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	1	18	1	-	3,716
	3	10	-	-	-	-	-	-	-	3	-	59	-	-	27	-	-	-	-	-	93	-	4,640
	4	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	31	3	1	2,625
	5	52	-	-	-	-	-	-	-	-	28	6	-	-	-	7	-	-	-	592	-	-	8,939
	6	1430	-	1	-	-	-	2	-	-	7	3	-	-	-	-	-	-	1	185	-	-	155,140
	7	-	2	1	1	-	-	-	1	-	3	4	45	-	56	-	-	1	-	-	-	-	42,823
	8	-	-	1	-	-	-	-	-	1	1	-	1	-	59	-	-	-	-	9	-	-	12,036
	9	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	2	-	-	0,010
	10	-	-	-	1	-	-	-	-	-	1	-	1	-	-	-	-	-	1	4	-	-	0,287
	11	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	0,034
	12	556	1	-	-	1	1	4	-	-	26	2	-	1	-	-	-	-	1	129	-	-	53,178
	13	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	-	-	-	-	0,287
	14	1560	-	-	-	-	-	-	1	1	10	1	-	-	-	-	-	1	-	139	-	-	63,028
	15	201	-	-	-	-	-	2	1	-	1	12	2	-	-	-	4	1	-	-	-	-	14,093
	16	1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	13	-	1	8	-	-	1,052
	17	436	-	-	-	-	-	1	-	11	-	13	-	-	-	-	255	-	17	-	-	-	33,194
NORTH LAKE	18	31	-	-	-	-	-	4	-	25	2	20	-	-	-	-	241	-	7	9	-	-	18,171
	19	92	-	-	-	-	-	-	-	-	10	-	-	-	-	-	30	-	146	-	-	-	23,104
	20	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,352
	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41	-	-	-	-	-	0,845
	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31	-	1	-	-	-	0,406
	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	-	1	1	-	-	0,178
	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	78	-	-	-	-	-	1,238
	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87	-	-	-	-	-	0,930
	26	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	813	-	-	-	-	-	4,426
	27	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	61	-	-	-	-	-	1,162
	28	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	435	-	-	-	-	-	1,810
	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	97	-	-	-	-	-	1,218
	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64	-	-	-	-	-	0,682
	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	**
	32	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	224	-	3	1	-	-	2,761
	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	205	-	1	-	-	-	1,848
	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	0,587
	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49	-	-	-	-	-	0,650
FALSE BAY	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	0,086
	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Species not previously recorded from St Lucia.

** Specimen not adequately formalized for gravimetric analysis.

The biomass distribution of the fauna is very uneven for no very obvious reasons. Stations with high total weights are often, but by no means consistently on basically sandy rather than muddy substrates but the correlation is very poor. Samples with more then 10 mg/0.025m/2 (0.44 gm/m^2) are shown in Table 3.

Table 3

Station No.	No. of Sp.	Total Weight mg/0,0225 m^2	Principal sp. by weight	Wt. of principal species*
6	7	155,140	Assiminea (1430)	133,573*
7	9	42,823	Tellina (1)	38,838*
8	6	12,036	Nassarius (1)	11,36*
13	10	53,176	Assiminea (556)	45,066*
14	7	63,028	" (1560)	53,566*
15	9	14,093	" (201)	12,507*
17	6	33,194	" (436)	24,462*
18	8	18,171	Macoma (1)	7,232*
19	4	23,104	Chironomidae (146)	14,846

* Shell free dried weight.

Samples showing these high values fall into two categories; those biased by single large individuals or those with substantial numbers of Assiminea bifasciata and in one case (St. 19) a large number of Chironomid larvae. Samples with single large individuals are not really representative, since the spatial distribution of the animals in the lake is probably such that the probability of their being included in the sample is small. Boltt (1969) has already pointed out the inefficiency with which the van Veen grab samples animals of this order of size. These fortuitous catches however do indicate that these species are present in St Lucia and have probably survived the high salinities in spite of a high mortality reported by Wallace (unpublished). The high numbers of Assiminea point to various rich feeding areas in the lake, forming a substantial quantity of readily available food for fish. Certain species can utilize shelled molluscs; for example Gerres oyena have been shown by Allanson (unpublished) to utilize Modiolus capensis as a principle part of its diet in Lake Nhlange.

The average biomass with the single individuals of large species removed is 20.8 mg/0.0225 m^2 or 0.925 gm/m^2 which is not very striking. However, it is unwise to use this figure as it stands since the sampling program was not complete enough to

indicate the extent of areas of high biomass (such as St. 17 with nearly 7 gm/m^2) or vice versa. All that can be indicated is that South lake in general is on the average more productive than North lake from the open water benthos point of view, and that certain areas are relatively very rich in biomass.

Discussion

The sampling programme was undoubtedly thinly spread over such a large area as the St Lucia lakes. However, the results are nevertheless significant. The lack of faura in False Bay, and the very restricted fauna of the Northern Basin north of Lane Island were to be expected. The variety and density of fauna in the Southern Lake regions, however, was highly surprising, indicating a more salinity resistant fauna than might have been expected.

Consideration of the ion species which change with increased salinity may be helpful. At about $70^{o}/oo$ $CaCO_3$ is precipitated from the water (B.J. Copeland 1967). This may form the first serious barrier to a fauna already adapted to fluctuating salinity conditions (Day 1964). This may be the reason behind the abrupt change of diversity of the North basin.

Changes in benthic populations

Previous reports are difficult to use as guidelines as to what may have been found in the open water benthos of the St Lucia system. Day, Millard and Broekhuysen (1954) reported the results including "dredging". It is not clear what dredge was used, but judging from the comparative faunal list, smaller forms may have been overlooked. It is unlikely that the new glycerid polychaete Glycinde capensis was not previously in the system. Those small forms which appear in the list (Day et al 1954) and Millard and Broekhuysen (1970) can be collected from marginal sampling as well as from more open water stations. From experience (Boltt 1969a) it would appear that certain forms which might have been expected from the South Lake samples are missing. Such forms are Corophium triaenonyx, Cyathura carinata, Modiolus capensis and isopods such as Cirolana luciae and C. fluviatalis. This is not to say that these forms have disappeared from the system; they probably do occur in marginal areas. However, one would expect them to have formed a substantial part of benthos sampled by the method used.

The fluctuating salinity regimes of St Lucia have been a matter of concern since they were first investigated by Day, Broekhuysen and Millard (1954) and more latterly Millard and Broekhuysen (1970). Day et al (1954) indicated a correlation between rainfall and salinity

regime in the St Lucia lakes. Millard and Broekhuysen (1970) suggested that some sort of cycling of high salinities and low salinities is to be expected in the lakes. They also suggested that during dry spells with increased salinities there was a severe effect on animal populations in the lake. Weeds die, migratory forms desert the area and move further down the system, non mobile forms would disappear. These suggestions seem to have been borne out in some measure by the present survey.

It is, however, likely that certain forms may recover rapidly. Certain benthic forms are now known to have a short reproductive period and planktonic dispersal mechanisms. Thus Grandidierella lignorum reaches maturity in two months at 20°C. This would allow of rapid recolonization in lowered salinities. It remains to be seen whether the fauna can in fact recover fairly rapidly with the mechanisms available.

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Further Information from St Lucia

A further series of about 60 samples was taken from St Lucia in July 1972. The processing of the samples is not complete and only results from about half the samples are available at present. The results thus far obtained show clear changes of the greatest importance in the general understanding of the St Lucia system, and also towards those of the coastal lakes in general.

Salinity. The salinities of the various basins has declined significantly from January to about 20°/oo.

Faunal Distribution. Reinvasion of much of the normal fauna into all parts of the lake has been demonstrated. This is especially significant in False Bay and North Basin. Although all species recorded from South Basin have not entirely redistributed themselves in St Lucia, those with planktonic larvae have. Of especial significance is the redistribution into North Basin of Solen and Pitaria, both of which form an important part of the diet of some of the fishes of the St Lucia System. The small crustacea (Amphipoda and Tanaidacea) have extended their ranges of distribution but not to the extent of other forms. It is suggested that the relatively small reproductive potential compared with those forms with planktonic larvae have inhibited the rate of recolonization of the St Lucia System.

Biomass. Increases in biomass from two to ten-fold have been recorded in all stations that were previously sampled. The production of the system can be estimated roughly from this increase, and demonstrates the highly productive nature of the secondary producers in the St Lucia System.

A further survey is planned for January, 1973.