# AN ASSESSMENT OF MUSSEL MORTALITY CAUSED BY A DROP IN THE WATER LEVEL OF LAKE KARIBA

LAKE KARIBA FISHERIES RESEARCH INSTITUTE

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by

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## INTRODUCTION

The level of Lake Kariba steadily fell during the period 1 June 1979 to 2 February 1980, except for a two-week period during December when it was allowed to rise slightly. Following this the level was again drawn down in anticipation of the Upper Zambezi flood water reaching the lake. At its highest level in June 1979 the lake was 487.42 m above sea level but by February 1980 it had dropped to 484.53 m, a total drop of 2.89 m. This left a considerable area of exposed shoreline and a large number of stranded mussels.

This report presents the results of an attempt to estimate the mussel mortality, carried out from 28 January to 1 February 1980. The study area extended from the Charara river mouth to Andora harbour with a total of 24 stations (Fig. 1).

## METHODS

Two or three sites of a known area were sampled at each station. All mussels at each site were collected and the numbers of each species determined. Live mussels were noted separately.

## RESULTS

The following species were found:

Caelatura mossambicensis (von Martens) referred to as Type I; Mutela dubia (Gmelin) referred to as Type II and Aspatharia wahlbergi (Krauss) referred to as Type III.

The number of mussels at each station were as follows:

Station 1: (A small island just off the shore from Charara Camping site.)

Site 1. (5m x 5m) 1 - 2m from the waters edge. Muddy clay soil without vegetation.

Site 2. (3m x 5m) 2 - 3m from the waters edge. Sandy soil covered with Panicum repens.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 30 | 42 | Nil |
| Site 2. | 172 | 16 | 2 |
| Site 3. | 21 | 46 | Nil |
| Total | 223 | 104 | 2 |

Area = 55 $m^2$

Station 2: (A spit of land with the Charara river on one side and Charara bay on the other).

Site 1. (12m x 10m) On the waters edge, very soft and wet, grey sandy soil. No vegetation.

Site 2. (5m x 10m) 1 - 2m from the waters edge. Very soft, sandy soil covered in thick mulchy detritus with sparse Panicum repens cover.

Site 3. (1m x 10m) On the waters edge. Sandy soil with Panicum repens and stranded Salvinia molesta.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 153 + 1 Alive | 110 | 3 Alive |
| Site 2. | 52 | 157 | Nil |
| Site 3. | 114 + 7 Alive | 65 | Nil |
| Total | 319 + 8 Alive | 332 | 3 Alive |

Area = 180 $m^2$

Station 3:

Site 1. (7m x 10m) Dry mud. Sparse Panicum repens, dry Lagarosiphon and Salvinia molesta along the shoreline where the site bordered the lake.

Site 2. (20m x 7m) Adjacent to site 1 and similar with slightly less vegetation and wetter soil.

Site 3. (7m x 6m) Similar to site 2 extending just into substantial Panicum growth and stranded Salvinia.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 239 | 25 | Nil |
| Site 2. | 207 | 63 + 1 Alive | 1 |
| Site 3. | 177 | 14 | Nil + 2 Alive |
| Total | 623 | 102 + 1 Alive | 1 + 2 Alive |

Area = 252 $m^2$

Station 4:

Site 1. (10m x 10m) From present waterline extending as far as stranded Salvinia and Panicum. Damp sandy and rocky soil with drying Lagarosiphon cover.

Site 2. (4m x 5m) Just off the waters edge. Very rocky and dry ground with substantial Lagarosiphon and Potamogeton cover.

Site 3. (5m x 10m) Damp, sandy soil. Lagarosiphon and Potamogeton present.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 189 + 1 Alive | 13 + 3 Alive | 3 |
| Site 2. | 313 + 1 Alive | 7 | 1 + 2 Alive |
| Site 3. | 985 + 4 Alive | 27 | 1 + 3 Alive |
| Total | 1487 + 6 Alive | 47 + 3 Alive | 5 + 5 Alive |

Area = 170 $m^2$

Station 5: 1 Site only of 50m x 2m extending along the shoreline. Most of the area was rocky with little vegetation of any kind. The sample includes those mussels actually on the waters edge and accounts for the higher number of live mussels.

| Type | I | II | III |
|---|---|---|---|
| Total | 99 + 6 Alive | 79 + 3 Alive | 2 + 17 Alive |

Area = 100 $m^2$

Station 6: (Situated around the mouth of a small re-entrant.)

Site 1. (5m x 10m) Situated along the shoreline to the side of the re-entrant. Rocky ground covered with sparse Panicum repens, Potamogeton and Lagarosiphon.

Site 2. (12m x 7m) About ½m from the water, situated in the mouth of the re-entrant. Similar to site 1 with more silt and less rock, wetter ground with less vegetation.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 1223 + 7 Alive | 120 | Nil + 2 Alive |
| Site 2. | 304 + 3 Alive | 55 | 1 + 3 Alive |
| Total | 1527 + 10 Alive | 175 | 1 + 5 Alive |

Area = 134 $m^2$

Station 7: (Situated on a small island approximately 100m x 50m which was close to the shore with dense Panicum growth and stranded Salvinia extending about 2/3 of the way up to its highest point.)

Site 1. (15m x 5m) About 1m from the waters edge. Sandy ground with sparse Panicum growth and stranded Potomageton and Lagarosiphon.

Site 2. (4m x 7m) About 1m from the waters edge. Very gravelly ground with very sparse Panicum cover and a little dead Naias.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 218 + 26 Alive | 60 + 2 Alive | 3 |
| Site 2. | 92 | 11 | 2 + 19 Alive |
| Total | 310 + 26 Alive | 71 + 2 Alive | 5 + 19 Alive |

Area = 103 $m^2$

Station 8: Only 1 site 10m x 20m extending along the water line. Gravelly surface with sparse Panicum, a little dead Lagarosiphon and Potamogeton. Dense vegetation in the surrounding water.

| Type | I | II | III |
|---|---|---|---|
| Total | 382 + 1 Alive | 31 | 9 + 5 Alive |

Area = 200 $m^2$

Station 9:

Site 1. (40m x 5m) Extended along the water's edge. Sandy soil with dense deposits of Lagarosiphon and sparse Panicum and Salvinia.

Site 2. (5m x 5m) 1 - 2m from the water's edge. Similar to site 1 with softer, wetter soil.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 276 + 18 Alive | 184 + 6 Alive | 1 + 3 Alive |
| Site 2. | 23 | 30 | Nil |
| Total | 299 + 18 Alive | 214 + 6 Alive | 1 + 3 Alive |

Area = 225 $m^2$

Station 10:

Site 1. (25m x 3m) Just above the water's edge on soft, slightly gravelly ground with stranded Naias. The sample area reached up to just below the old water level where abundant Panicum growth occurred.

Site 2. (10m x 10m) 1 - 7m from the water's edge on gravelly ground covered in Panicum and dead Salvinia, Lagarosiphon and Potamogeton.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 95 + 1 Alive | 18 | 4 + 7 Alive |
| Site 2. | 236 | 52 | 1 + 20 Alive |
| Total | 331 + 1 Alive | 70 | 5 + 27 Alive |

Area = 175 $m^2$

Station 11: 1 site only of 25m x 10m. From just off the water's edge to about 2m from it. Slightly gravelly ground with substantial growth of Potamogeton, with Lagarosiphon and Naias also occurring. Stranded Salvinia and sparse Panicum.

| Type | I | II | III |
|---|---|---|---|
| Total | 537 | 108 | 2 Alive |

Area = 250 $m^2$

Station 12: 1 site only of 5m x 5m about 1m from the water's edge. Very moist grey sandy soil. Thickly covered with stranded Salvinia and very sparse Panicum which was growing in abundance at the high water mark, 7m from sample area.

| Type | I | II | III |
|---|---|---|---|
| Total | 85 | 11 | 8 Alive |

Area = 25 $m^2$

Station 13: 1 site only of 10m x 15m. Ranging from 3 - 5m away from the water's edge. Sparse Panicum and Naias, Lagarosiphon and Potamogeton growing on stony/sandy ground.

| Type | I | II | III |
|---|---|---|---|
| Total | 1283 | 41 | 3 + 16 Alive |

Area = 150 $m^2$

Station 14:

Site 1. (5m x 5m) On the water's edge. Dry sand supporting Panicum Potamogeton and Lagarosiphon.

Site 2. (15m x 8m) About 1m from the waters edge. Very sandy, fairly moist soil with a little growth of Potamogeton.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 1012 + 20 Alive | 25 + 1 Alive | 1 + 6 Alive |
| Site 2. | 110 | 31 | Nil |
| Total | 1122 + 20 Alive | 56 + 1 Alive | 1 + 6 Alive |

Area = 145 $m^2$

Station 15:

Site 1. (8m x 10m) On the water's edge. Ground very sandy to muddy near the water. Sparse Panicum, Lagarosiphon and Potamogeton.

Site 2. (5m x 7m) 1 - 3m from the water's edge. Similar to site 1 with more dense vegetation.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 893 + 11 Alive | 25 | 1 + 3 Alive |
| Site 2. | 432 | 15 | 2 Alive |
| Total | 1325 + 11 Alive | 40 | 1 + 5 Alive |

Area = 115 $m^2$

Station 16: 1 site only of 20m x 20m. About 1 - 10m from the water's edge. Soft, sandy soil supporting Panicum, Lagarosiphon and Potamogeton.

| Type | I | II | III |
|---|---|---|---|
| Total | 5648 | 260 | 1 + 2 Alive |

Area = 400 $m^2$

Station 17:

Site 1. (5m x 12m) 1 - 2m from the water's edge. Gravelly and rocky ground with substantial growth of Panicum and light cover of Potamogeton, Lagarosiphon and some stranded Salvinia.

Site 2. (5m x 10m) About 1m from the water's edge. Similar to site 1 but more rocky ground with very little vegetation.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 30 | 2 | 1 |
| Site 2. | 31 | Nil | 2 |
| Total | 61 | 2 | 3 |

Area = 110 $m^2$

Station 18:

Site 1. (10m x 10m) 1 - 3m from the water's edge. Gravelly and rocky ground becoming more sandy away from the water. Panicum, Lagarosiphon Naias and Potamogeton present.

Site 2. (10m x 3m) Situated on a spit of land and sample area about 1m from water on three sides. Similar to site 1 but with less vegetation.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 943 | 12 | 5 Alive |
| Site 2. | 237 | 3 | Nil |
| Total | 1180 | 15 | 5 Alive |

Area = 130 $m^2$

Station 19:

Site 1. (10m x 10m) About ½m from the water's edge. Soft muddy soil becoming sandier and drier away from the water. Sparse Panicum with a little Lagarosiphon and Potamogeton.

Site 2. (10m x 10m) This site was as similar as possible to site 1 in order to compare populations on the same type of ground. Site 2 was about 50m from site 1 and the ground was slightly sandier with more Lagarosiphon and less Potamogeton.

| Type | I | II | III |
|---|---|---|---|
| Site 1. | 505 | 5 | Nil |
| Site 2. | 431 | 7 | Nil |
| Total | 936 | 12 | Nil |

Area = 200 $m^2$

Station 20: Only 1 site 17m x 5m, cutting across a spit of land about 20m from the point. The area extended from water's edge on one side to water's edge on the other. Sandy soil strewn with rocks and thickly covered with Salvinia, Lagarosiphon, Potamogeton, Naias and Vallisneria.

| Type | I | II | III |
|---|---|---|---|
| Total | 333 + 20 Alive | 19 | 4 Alive |

Area = 85 $m^2$

Station 21: Only 1 site 10m x 5m, about 1m from the water's edge on very pebbly, rocky ground. Light vegetation cover.

| Type | I | II | III |
|---|---|---|---|
| Total | 383 + 6 Alive | 7 | 1 Alive |

Area = 50 $m^2$

Station 22: Only 1 site 12m x 25m, on a very sandy beach near Kariba Breezes Hotel. Situated just off the water's edge with a little stranded Salvinia and very little Lagarosiphon and Potamogeton

| Type | I | II | III |
|---|---|---|---|
| Total | 31 | Nil | Nil |

Area = 300 $m^2$

Station 23: Only 1 site 5m x 100m, along the water's edge. A long narrow, rocky beach at the foot of a steep incline situated near the Caribbea Bay Marina. Some stranded Salvinia.

| Type | I | II | III |
|---|---|---|---|
| Total | 8 | 1 | Nil |

Area = 500 $m^2$

Station 24: Only 1 site 5m x 10m, along the water's edge. Very sparse Panicum with a little stranded Salvinia and thick deposits of Lagarosiphon close to the water.

| Type | I | II | III |
|---|---|---|---|
| Total | 52 | 2 | Nil |

Area = 50 $m^2$

A total area of 4104 $m^2$ was sampled, with a total number and density of mussels as follows.

| | Numbers | | Density |
|---|---|---|---|
| | Dead | Alive | no $m^{-2}$ |
| I Caelatura mossambicensis | 18 584 | 133 | 4.56 |
| II Mutela dubia | 1 789 | 16 | 0.44 |
| III Aspatharia wahlbergi | 38 | 146 | 0.37 |
| Total | 20 411 | 295 | 5.37 |

## DISCUSSION

From the Lake Kariba area/capacity curve (Ministry of Water Development, 1975) the exposed shoreline was about 250 $km^2$. Since the Zimbabwe-Rhodesian shoreline is about 54.6% of the total (Balon & Coche, 1974) then the total loss of mussels can be estimated as follows.

| | Whole Lake | Zimbabwe Rhodesia |
|---|---|---|
| Caelatura mossambicensis | 1 140 000 000 | 638 000 000 |
| Mutela dubia | 110 000 000 | 61 600 000 |
| Aspatharia wahlbergi | 925 000 | 518 000 |
| Total | 1 250 925 000 | 700 118 000 |

These figures must, of course, be regarded as approximate but they do give some indication of the very large quantity of mussels that can be exposed by a lake-level drop. It is interesting to note that a high proportion of A. wahlbergi were still alive and it is possible that they are better able to survive exposure or to keep up with the falling water.

## REFERENCES

Balon, E.K. & Coche, A.G. (Eds.) 1974. Lake Kariba : a man-made tropical ecosystem in Central Africa. The Hague : W. Junk

Ministry of Water Development, 1975. Hydrological Yearbook 1974-75. Salisbury : Government Printer.

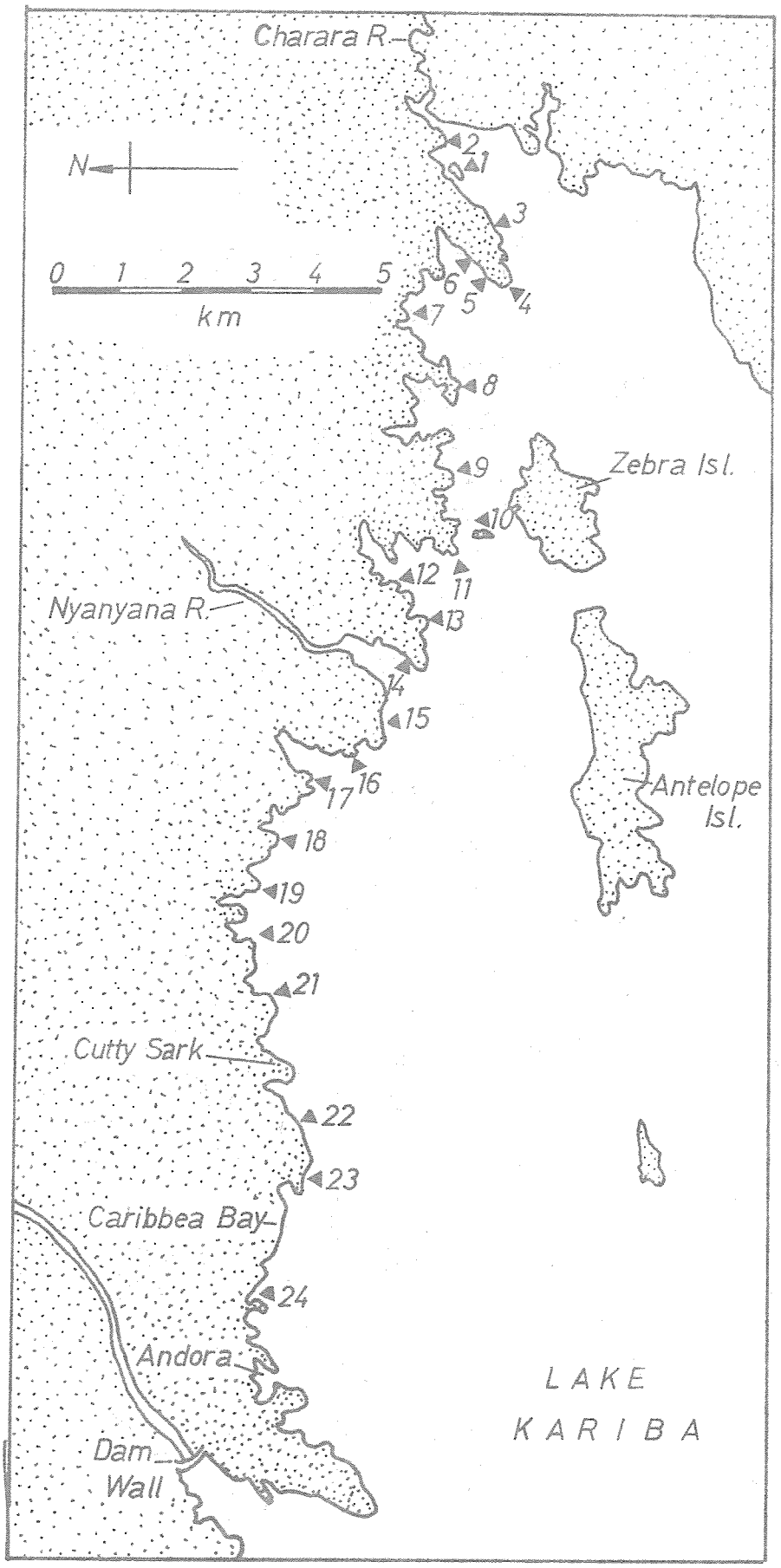


Figure 1 : Lake Kariba shoreline, showing sampling stations.