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Schistosomiasis transmission in Lake Malawi

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Schistosomiasis (bilharziasis) transmission due to *Schistosoma haematobium* has for many years been known to occur along protected shorelines in Lake Malawi, but the recent finding that transmission also can also occur along open shorelines with sandy sediment has had a detrimental effect on tourism to Lake Malawi. The present paper shows that transmission, as evidenced from presence of intermediate hosts, along open shorelines is occurring in the southern part of the Lake. Relatively simple precautions can be taken to ensure minimal risk of attracting schistosome infection, and the schistosomiasis risk should not deter people from visiting and diving in Lake Malawi.

Keywords: bilharziasis, *Bulinus*, *Schistosoma haematobium,* schistosome infection, tourism

Introduction

Although *Schistosoma haematobium* transmission has been recognised in Lake Malawi for many years (Wright 1973, Teesdale and Chitsulo 1985, Jordan and Webbe 1996) an increase in transmission seems to have occurred over recent years (Cetron *et al*. 1996). This is partly judged on the many published records of schistosome infections in tourists returning from visits to Lake Malawi (Cetron *et al*. 1996, Day *et al*. 1996, Potasman *et al*. 1996, Cooke *et al*. 1999, and others) and on the high prevalences of infection in lakeshore fishing communities (Bloch *et al*. 2001). Cetron *et al*. (1996) estimate that 5 000 resident expatriates and tourists acquire schistosomiasis from Lake Malawi each year, especially in the area of Nankumba Peninsula, where the Lake Malawi National Park at Cape Maclear is one of the most frequented tourist attractions in Malawi. Clearly, urinary schistosomiasis is a major public health problem in many fishing communities around Lake Malawi (Bloch *et al*. 2001). A decline in the density of certain species of molluscivorous cichlids has been demonstrated and it has been suggested that this has resulted in an increase in the density of schistosome intermediate host snails and subsequently of schistosome transmission (Stauffer *et al*. 1997).

Bulinus globosus is well known as intermediate host for *S. haematobium* in the area, but since this species is not common in open lake habitats it was previously believed that the open exposed shores were free from infection (Evans 1975, Pugh 1993, Stauffer *et al*. 1997). However, Madsen *et al*. (2001) showed that transmission also takes place in the lake along exposed shorelines where the sediment is composed of sand or gravel where *Bulinus nyassanus*, a species endemic to Lake Malawi, is the intermediate host.

The present paper reviews schistosome transmission in Lake Malawi on the basis of published work and preliminary results from three surveys conducted during 2003 in a number of locations around the lake (Figure 1). During these surveys snails were searched by various techniques in the lake and in adjacent inland habitats.

Summary of schistosome transmission

Transmission in lake-shore areas can take place directly in the lake or in inland habitats such as rivers or ponds close to the shore. There are two possibilities for transmission within the lake itself; either (a) by cercariae produced within the lake or (b) by those transported into the lake by inflowing streams or rivers.

Transmission within the lake itself

Transmission by parasites produced within the lake occurs in two habitats, i.e. (1) along sandy beaches with human water contact, where *Bulinus nyassanus* is the intermediate host and (2) along relatively protected shorelines such as harbours or calm bays, where *B. globosus* is primarily responsible as the intermediate host. *Bulinus nyassanus* is endemic to Lake Malawi and can be found at considerable

depths in different parts of the lake but, along beaches with sand or gravel sediment, its density can be high even in fairly shallow water (depths from about 0.7m) close to the shoreline, especially where the sediment is gravel and the shoreline is somewhat protected. At more exposed shorelines, and along shorelines with finer sediment, it may be abundant at greater depths. The depth of highest density varies among sites and among seasons. Transmission is most intense from about May to October, although there could be deviations from this depending on the degree of exposure of the shoreline.

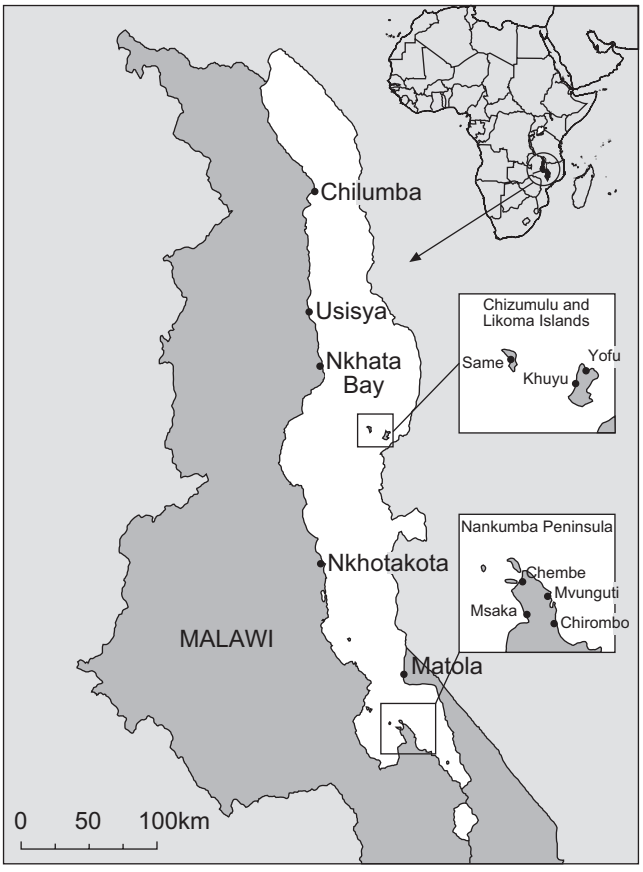

Figure 1: Lake Malawi and sample sites

Bulinus nyassanus is widely distributed within the lake but in most places it is not found at high density (Table 1). Among the sites examined outside Nankumba Peninsula, high density was found only at Matola. North of this area we have found *B. nyassanus* at relatively low density and at greater depths (Table 1). To date no infected *B. nyassanus* have been found in the northern part of the lake, but more rigorous investigations are required before conclusions can be drawn about its role in transmission in this area. *Bulinus succinoides* is found at several sites but this thin-shelled species, found in association with aquatic macrophytes (*Vallisneria* sp.), is not incriminated as intermediate host.

Transmission in protected areas, where *Bulinus globosus* is the primary intermediate host, may take place during the rainy season (January–April) and part of the dry season. *B. globosus* is found on aquatic macrophytes close to the shoreline or on boulders in relatively shallow water where they seem to gain protection against both predators and wave action. This type of transmission can occur throughout the lake where such habitats exist and where there is human/water contact.

The northern part of the lake can be exposed to strong wave action for prolonged periods of time due to strong south winds (the so-called *Mwera*) during June–August and this, in combination with the selected northern sites being more exposed, may partly explain why *B. nyassanus* is not normally found in shallower water except at the southern end of the lake. In December–January strong northerly winds prevail, and these may be the prime cause for the disappearance of *B. nyassanus* from the shallow waters in the southern part of the lake during that time of year. Other factors, such as siltation during the rainy season, might also play a part.

Cercariae produced in inland habitats

Transmission by cercariae produced in rivers seems particularly intense during the rainy season and for some time

Table 1: Occurrence of *Bulinus* sp. in different localities (see Figure 1) visited three times (January, March/April and October) in 2003. * Judged on basis of different sampling techniques, ** Within 200m from shoreline, – not found, + present, ++ common, +++ high density

	Bulinus globosus		*Bulinus nyassanus*		*Bulinus succinoides*		Maximum depth
	Inland	Lake	Density*	Minimum depth (m)	Density*	Minimum depth (m)	(m) sampled**
Chilumba	–	–	+	4.6	–		6.1
Usisya		–	+	4.6	–		6.1
Nkhata Bay		++	+	7.6	–		9.1
Khuyu		–	–		+	4.6	6.1
Yofu		–	+	3.0	++	3.0	9.1
Same Bay	+++	++	+	6.1			9.1
Matola	–	–	+++	1.5	++	1.5	6.1
Nankumba Peninsula							
Chembe	+	–	+++	1.5	+		9.1
Chirombo Bay	–	–	++	1.5	–		4.6
Msaka	+++	+	++	1.5	–		9.1
Mvunguti	+++	–	+	3.0	+	7.6	9.1

afterwards, but could be for longer, depending on local conditions. Once water stops flowing after the rain stops, rivers become isolated from the lake and small pools are formed on the shores and some distance inland. These pools can contain very high population densities of *Bulinus globosus* which are often found to be infected. People, especially children, may have water contact in these pools, many of which usually would dry up completely during the dry season.

Other ponds may form and persist entirely due to the regular inflow of water from wave action and we have found infected *B. globosus* in such locations (for example, sites at Nkotakota and Same Bay).

Recommendations for visitors to Lake Malawi

Adhering to the following simple guidelines will minimise (but not necessarily eliminate) the risk of schistosome infection. Following visits to Lake Malawi, be aware of symptoms like fatigue or flu-like symptoms, and consult a medical doctor for an examination.

- Do not get into contact with water in streams and ponds behind the shoreline, as these habitats are potential high-risk transmission sites (as they are in most other African countries).
- Do not have water contact in harbour areas and other protected areas of the lake where local people have water contact.
- Do not have water contact close to inflowing streams. During the rainy season, do not have water contact close to villages, as most will have such streams in their vicinity.
- Swimming and diving in the lake 200m (and probably even 100m) away from the shore would result in minimal risk of attracting schistosome infection, even outside village areas where transmission occurs. Along isolated shorelines swimming and diving from the shore should not result in exposure to schistosome cercariae.
- Have a medical examination for schistosome infection performed about two months after visiting Lake Malawi.

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