

## Some Occupational Diseases in Culture Fisheries Management and Practices Part Two: Schistosomiasis and Filariasis

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**Abstract:** The part two of some occupational diseases in culture fisheries management and practices is discussed in this study to provide fish culturist knowledge on more health implications in culture management and practices. Schistosomiasis and Filariasis are some occupational diseases in culture fisheries management and practices reviewed to create awareness of the health implications in aquaculture. The pond environment is suitable for Schistosomiasis and Filariasis. Snails serve as the intermediary agent between mammalian hosts of Schistosomiasis. Although it has a low mortality rate, schistosomiasis often is a chronic illness that can damage internal organs and, in children, impair growth and cognitive development. Filariasis is considered is caused by thread-like nematodes (roundworms) belonging to the superfamily Filarioidea. Lymphatic filariasis is caused by the worms *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori*. Subcutaneous filariasis is caused by *Loa loa* (the eye worm), *Mansonella streptocerca* and *Onchocerca volvulus*. These worms occupy the subcutaneous layer of the skin, in the fat layer. Serous cavity filariasis is caused by the worms *Mansonella perstans* and *Mansonella ozzardi*, which occupy the serous cavity of the abdomen. The adult worms, which usually stay in one tissue, release early larvae forms known as microfilariae into the host's bloodstream. These are transmitted from host to host by blood-feeding arthropods, mainly black flies and mosquitoes. This study reviews the classification, life cycle, Signs and symptoms, pathophysiology, diagnosis, prevention, treatment, epidemiology, society and culture of Schistosomiasis and Filariasis to create the required health implications in culture fisheries.

**Keywords:** Culture fisheries, filariasis, occupational diseases, schistosomiasis

### INTRODUCTION

Sustainable culture fisheries management and practices is not free from some occupational diseases. The pond environment is suitable for Schistosomiasis and Filariasis. Schistosomiasis is known as bilharzia or bilharziosis in many countries, after Theodor Bilharz, who first described the cause of urinary schistosomiasis in 1851. The first doctor who described the entire disease cycle was Pirajá da Silva in 1908. It was a common cause of death for Ancient Egyptians in the Greco-Roman Period (Kheir *et al.*, 1999). Snails serve as the intermediary agent between mammalian hosts. Individuals within developing countries who cannot afford proper sanitation facilities are often exposed to contaminated water containing the infected snails (Botros *et al.*, 2005). Although it has a low mortality rate, schistosomiasis often is a chronic illness that can damage internal organs and, in children, impair growth and cognitive development (Oliveira *et al.*, 2004; Strickland, 2006). The urinary form of schistosomiasis is associated with increased risks for bladder cancer in adults. Schistosomiasis is the second most

socioeconomically devastating parasitic disease after malaria. This disease is most commonly found in Asia, Africa and South America, especially in areas where the water contains numerous freshwater snails, which may carry the parasite (Soliman, 2004). The disease affects many people in developing countries, particularly children who may acquire the disease by swimming or playing in infected water (Oliveira *et al.*, 2004). As children come into contact with the contaminated water source the parasitic snail larva easily enter through the human skin and further mature within organ tissues (Kheir *et al.*, 1999).

Filariasis (philariasis) is considered an infectious tropical disease, that is caused by thread-like nematodes (roundworms) belonging to the superfamily Filarioidea, also known as "filariae". These are transmitted from host to host by blood-feeding arthropods, mainly black flies and mosquitoes. Eight known filarial nematodes use humans as their definitive hosts (Taylor *et al.*, 2005). These are divided into three groups according to the niche within the body they occupy: 'lymphatic filariasis', 'subcutaneous filariasis' and 'serous cavity filariasis'. Lymphatic filariasis is caused by the worms

*Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori*. These worms occupy the lymphatic system, including the lymph nodes and in chronic cases these worms lead to the disease elephantiasis. Subcutaneous filariasis is caused by *Loa loa* (the eye worm), *Mansonella streptocerca* and *Onchocerca volvulus*. These worms occupy the subcutaneous layer of the skin, in the fat layer. *L. loa* causes *Loa loa* filariasis while *O. volvulus* causes river blindness (Taylor *et al.*, 2005).

Serous cavity filariasis is caused by the worms *Mansonella perstans* and *Mansonella ozzardi*, which occupy the serous cavity of the abdomen (Taylor *et al.*, 2005). The adult worms, which usually stay in one tissue, release early larvae forms known as microfilariae into the host's bloodstream. These circulating microfilariae can be taken up with a blood meal by the arthropod vector; in the vector they develop into infective larvae that can be transmitted to a new host. Individuals infected by filarial worms may be described as either "microfilaraemic" or "amicrofilaraemic", depending on whether or not microfilaria can be found in their peripheral blood. Filariasis is diagnosed in microfilaraemic cases primarily through direct observation of microfilaria in the peripheral blood. Occult filariasis is diagnosed in amicrofilaraemic cases based on clinical observations and, in some cases, by finding a circulating antigen in the blood (Taylor *et al.*, 2005). A review the classification, life cycle, Signs and symptoms, pathophysiology, diagnosis, prevention, treatment, epidemiology, society and culture of Schistosomiasis and Filariasis to create the required health implications in culture fisheries is inevitable in culture fisheries management and practices.

## SCHISTOSOMIASIS

Schistosomiasis (also known as bilharzia, bilharziosis or snail fever) is a parasitic disease caused by several species of trematodes (platyhelminth infection, or "flukes"), a parasitic worm of the genus *Schistosoma* (Kheir *et al.*, 1999). Snails serve as the intermediary agent between mammalian hosts. Individuals within developing countries who cannot afford proper sanitation facilities are often exposed to contaminated water containing the infected snails. Although it has a low mortality rate, schistosomiasis often is a chronic illness that can damage internal organs and, in children, impair growth and cognitive development. The urinary form of schistosomiasis is associated with increased risks for bladder cancer in adults (Soliman, 2004). Schistosomiasis is the second most socioeconomically devastating parasitic disease

after malaria. This disease is most commonly found in Asia, Africa and South America, especially in areas where the water contains numerous freshwater snails, which may carry the parasite (Botros *et al.*, 2005).

The disease affects many people in developing countries, particularly children who may acquire the disease by swimming or playing in infected water. As children come into contact with the contaminated water source the parasitic snail larva easily enter through the human skin and further mature within organ tissues (Plate 1). As of 2009, 74 developing countries statistically identified epidemics of Schistosomiasis within their respective populations (Kheir *et al.*, 1999).

**Classification:** Species of *Schistosoma* that can infect humans:

- *Schistosoma mansoni* (ICD-10 B65.1) and *Schistosoma intercalatum* (B65.8) cause intestinal schistosomiasis
- *Schistosoma haematobium* (B65.0) causes urinary schistosomiasis
- *Schistosoma japonicum* (B65.2) and *Schistosoma mekongi* (B65.8) cause Asian intestinal schistosomiasis
- Avian schistosomiasis species cause swimmer's itch and clam digger itch
- Species of *Schistosoma* that can infect other animals:
  - *S. bovis* — normally infects cattle, sheep and goats in Africa, parts of Southern Europe and the Middle East
  - *S. matthei* — normally infects cattle, sheep and goats in Central and Southern Africa
  - *S. margrebowiei* — normally infects antelope, buffalo and waterbuck in Southern and Central Africa
  - *S. curassoni* — normally infects domestic ruminants in West Africa
  - *S. rodhaini* — normally infects rodents and carnivores in parts of Central Africa

**Signs and symptoms:** Above all, schistosomiasis is a chronic disease. Many infections are subclinically symptomatic, with mild anemia and malnutrition being common in endemic areas. Acute schistosomiasis (Katayama's fever) may occur weeks after the initial infection, especially by *S. mansoni* and *S. japonicum* (Botros *et al.*, 2005). Manifestations include:

- Abdominal pain
- Cough
- Diarrhea



Plate 1: Skin vesicles on the forearm, created by the penetration of *Schistosoma*, ([http://en.wikipedia.org/wiki/file:schistosomiasis\\_itch.jpeg](http://en.wikipedia.org/wiki/file:schistosomiasis_itch.jpeg))

- Eosinophilia — extremely high eosinophil granulocyte (white blood cell) count
- Fever
- Fatigue
- Hepatosplenomegaly — the enlargement of both the liver and the spleen. Hepatic schistosomiasis is the second most common cause of esophageal varices worldwide.
- Genital sores — lesions that increase vulnerability to HIV infection.

Lesions caused by schistosomiasis may continue to be a problem after control of the schistosomiasis infection itself. Early treatment, especially of children, which is relatively inexpensive, prevents formation of the sores.

**Skin symptoms:** At the start of infection, mild itching and a papular dermatitis of the feet and other parts after swimming in polluted streams containing cercariae.

Occasionally central nervous system lesions occur: cerebral granulomatous disease may be caused by ectopic *S. japonicum* eggs in the brain and granulomatous lesions around ectopic eggs in the spinal cord from *S. mansoni* and *S. haematobium* infections may result in a transverse myelitis with flaccid paraplegia.

Continuing infection may cause granulomatous reactions and fibrosis in the affected organs, which may result in manifestations that include:

- Colonic polyposis with bloody diarrhea (*Schistosoma mansoni* mostly)
- Portal hypertension with hematemesis and splenomegaly (*S. mansoni*, *S. japonicum*)
- Cystitis and ureteritis (*S. haematobium*) with hematuria, which can progress to bladder cancer
- Pulmonary hypertension (*S. mansoni*, *S. japonicum*, more rarely *S. haematobium*)
- Glomerulonephritis; and central nervous system lesions.

- Bladder cancer diagnosis and mortality are generally elevated in affected areas.

**Pathophysiology:** Schistosomes have a typical trematode vertebrate-invertebrate lifecycle, with humans being the definitive host (Fig. 1).

## SNAILS

The life cycles of all five human schistosomes are broadly similar: parasite eggs are released into the environment from infected individuals, hatching on contact with fresh water to release the free-swimming miracidium. Miracidia infect fresh-water snails by penetrating the snail's foot (Botros *et al.*, 2005). After infection, close to the site of penetration, the miracidium transforms into a primary (mother) sporocyst. Germ cells within the primary sporocyst will then begin dividing to produce secondary (daughter) sporocysts, which migrate to the snail's hepatopancreas. Once at the hepatopancreas, germ cells within the secondary sporocyst begin to divide again, this time producing thousands of new parasites, known as cercariae, which are the larvae capable of infecting mammals.

Cercariae emerge daily from the snail host in a circadian rhythm, dependent on ambient temperature and light. Young cercariae are highly mobile, alternating between vigorous upward movement and sinking to maintain their position in the water. Cercarial activity is particularly stimulated by water turbulence, by shadows and by chemicals found on human skin.

**Humans:** Penetration of the human skin occurs after the cercaria have attached to and explored the skin. The parasite secretes enzymes that break down the skin's protein to enable penetration of the cercarial head through the skin. As the cercaria penetrates the skin it transforms into a migrating schistosomulum stage. The newly transformed schistosomulum may remain in the skin for 2 days before locating a post-capillary venule; from here the schistosomulum travels to the lungs where it undergoes further developmental changes necessary for subsequent migration to the liver. Eight to ten days after penetration of the skin, the parasite migrates to the liver sinusoids. *S. japonicum* migrates more quickly than *S. mansoni* and usually reaches the liver within 8 days of penetration. Juvenile *S. mansoni* and *S. japonicum* worms develop an oral sucker after arriving at the liver and it is during this period that the parasite begins to feed on red blood cells. The nearly-mature worms pair, with the longer female worm residing in the gynaecophoric channel of the shorter



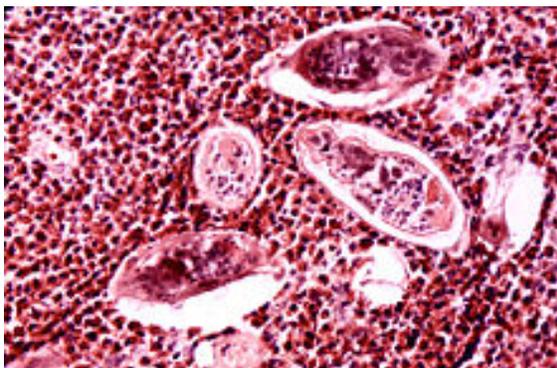


Plate 3: High powered detailed micrograph of schistosoma parasite eggs in human bladder tissue, (<http://en.wikipedia.org/wiki/file:schistosome20043-300.jpg>)

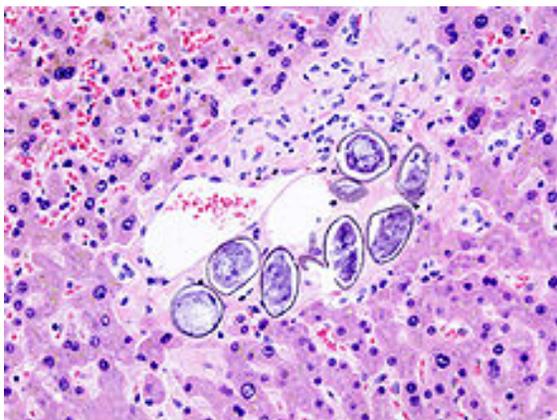


Plate 4: *S. japonicum* eggs in hepatic portal tract, ([http://en.wikipedia.org/wiki/file:schistosoma\\_japonicum\\_3\\_hitipathology.jpg](http://en.wikipedia.org/wiki/file:schistosoma_japonicum_3_hitipathology.jpg))

performed on a simple smear (1 to 2 mg of fecal material). Since eggs may be passed intermittently or in small amounts, their detection will be enhanced by repeated examinations and/or concentration procedures (such as the formalin-ethyl acetate technique). In addition, for field surveys and investigational purposes, the egg output can be quantified by using the Kato-Katz technique (20 to 50 mg of fecal material) or the Ritchie technique.

Eggs can be found in the urine in infections with *S. japonicum* and with *S. intercalatum* (recommended time for collection: between noon and 3 PM). Detection will be enhanced by centrifugation and examination of the sediment. Quantification is possible by using filtration through a nucleopore membrane of a standard volume of urine followed by egg counts on the membrane. Investigation of *S. haematobium* should also include a pelvic x-ray as bladder wall calcification is highly characteristic of chronic infection (Soliman, 2004).

Recently a field evaluation of a novel handheld microscope was undertaken in Uganda for the diagnosis of intestinal schistosomiasis by a team led by Dr. Russell Stothard from the Natural History Museum of London, working with the Schistosomiasis Control Initiative, London. Tissue biopsy (rectal biopsy for all species and biopsy of the bladder for *S. haematobium*) may demonstrate eggs when stool or urine examinations are negative. The eggs of *S. haematobium* are ellipsoidal with a terminal spine, *S. mansoni* eggs are also ellipsoidal but with a lateral spine, *S. japonicum* eggs are spheroidal with a small knob. Antibody detection can be useful in both clinical management and for epidemiologic surveys (Plate 3 and 4).

**Prevention:** Prevention is best accomplished by eliminating the water-dwelling snails that are the natural reservoir of the disease. Acrolein, copper sulfate and niclosamide can be used for this purpose. Recent studies have suggested that snail populations can be controlled by the introduction of, or augmentation of existing, crayfish populations; as with all ecological interventions, however, this technique must be approached with caution. In 1989, Aklilu Lemma and Legesse Wolde-Yohannes received the Right Livelihood Award for their research on the sarcoca plant, as a preventative measure for the disease by controlling the snail. Concurrently, Dr Chidzere of Zimbabwe researched the similar gopo berry during the 1980s and found that it could be used in the control of infected freshwater snails.

In 1989 he drew attention to his concerns that big chemical companies denigrated the gopo berry alternative for snail control. Gopo berries from hotter Ethiopia climates reputedly yield the best results. Later studies were conducted between 1993 and 1995 by the Danish Research Network for international health. For many years from the 1950s onwards, civil engineers built vast dam and irrigation schemes, oblivious to the fact that they would cause a massive rise in water-borne infections from schistosomiasis. The detailed specifications laid out in various UN documents since the 1950s could have minimized this problem. Irrigation schemes can be designed to make it hard for the snails to colonize the water and to reduce the contact with the local population. This has been cited as a classic case of the relevance paradox because guidelines on how to design these schemes to minimise the spread of the disease had been published years before, but the designers were unaware of them.

**Treatment:** Schistosomiasis is readily treated using a single oral dose of the drug praziquantel annually. As

with other major parasitic diseases, there is ongoing and extensive research into developing a schistosomiasis vaccine that will prevent the parasite from completing its life cycle in humans. In 2009, Eurogentec Biologics developed a vaccine against bilharziosis in partnership with INSERM and researchers from the Pasteur Institute. The World Health Organization has developed guidelines for community treatment of schistosomiasis based on the impact the disease has on children in endemic villages:

- When a village reports more than 50% of children have blood in their urine, everyone in the village receives treatment.
- When 20 to 50% of children have bloody urine, only school-age children are treated.
- When less than 20% of children have symptoms, mass treatment is not implemented.

The Bill & Melinda Gates Foundation has recently funded an operational research program—the Schistosomiasis Consortium for Operational Research and Evaluation (SCORE) to answer strategic questions about how to move forward with schistosomiasis control and elimination. The focus of SCORE is on development of tools and evaluation of strategies for use in mass drug administration campaigns. Antimony has been used in the past to treat the disease. In low doses, this toxic metalloid bonds to sulfur atoms in enzymes used by the parasite and kills it without harming the host. This treatment is not referred to in present-day peer-review scholarship; praziquantel is universally used. Outside of the U.S., there is a drug available exclusively for treating *Schistosoma mansoni* (oxamniquine) and one exclusively for treating *S. hematobium* (metrifonate). While metrifonate has been discontinued for use by the British National Health Service, a Cochrane review found it equally effective in treating urinary schistosomiasis as the leading drug, praziquantel. Mirazid, an Egyptian drug made from myrrh, was under investigation for oral treatment of the disease up until 2005. The efficacy of praziquantel was proven to be about 8 times that of Mirazid and therefore Mirazid was not recommended as a suitable agent to control schistosomiasis (Strickland, 2006).

**Epidemiology:** The disease is found in tropical countries in Africa, the Caribbean, eastern South America, Southeast Asia and in the Middle East. *Schistosoma mansoni* is found in parts of South America and the Caribbean, Africa and the Middle East; *S. haematobium* in Africa and the Middle East; and *S. japonicum* in the Far East. *S. mekongi* and *S. intercalatum* are found locally in Southeast Asia and central West Africa, respectively. Among human parasitic diseases, schistosomiasis (sometimes called

bilharziosis) ranks second behind malaria in terms of socio-economic and public health importance in tropical and subtropical areas. The disease is endemic in 74-76 developing countries, infecting more than 207 million people, 85% of whom live in Africa. They live in rural agricultural and peri-urban areas and placing more than 700 million people at risk. Of the infected patients, 20 million suffer severe consequences from the disease. Some estimate that there are approximately 20,000 deaths related to schistosomiasis yearly (Strickland, 2006).

In many areas, schistosomiasis infects a large proportion of children under 14 years of age. An estimated 600 million people worldwide are at risk from the disease. A few countries have eradicated the disease and many more are working toward it. The World Health Organization is promoting these efforts. In some cases, urbanization, pollution and/or consequent destruction of snail habitat has reduced exposure, with a subsequent decrease in new infections. The most common way of getting schistosomiasis in developing countries is by wading or swimming in lakes, ponds and other bodies of water that are infested with the snails (usually of the genera *Biomphalaria*, *Bulinus*, or *Oncomelania*) that are the natural reservoirs of the *Schistosoma* pathogen (Strickland, 2006).

**Society and culture:** Schistosomiasis is endemic in Egypt, exacerbated by the country's dam and irrigation projects along the Nile. From the late 1950s through the early 1980s, infected villagers were treated with repeated shots of tartar emetic. Epidemiological evidence suggests that this campaign unintentionally contributed to the spread of the hepatitis C virus via unclean needles. Egypt has the world's highest hepatitis C infection rate and the infection rates in various regions of the country closely track the timing and intensity of the anti-schistosomiasis campaign. Male menstruation, a misunderstood symptom caused by schistosomiasis (Oliveira *et al.*, 2004).

## FILARIASIS

Filariasis (philariasis) is a parasitic disease and is considered an infectious tropical disease, that is caused by thread-like nematodes (roundworms) belonging to the superfamily Filarioidea, also known as "filariae". These are transmitted from host to host by blood-feeding arthropods, mainly black flies and mosquitoes. Eight known filarial nematodes use humans as their definitive hosts. These are divided into three groups according to the niche within the body they occupy: 'lymphatic filariasis', 'subcutaneous filariasis' and 'serous cavity filariasis' (Taylor *et al.*, 2005).

Lymphatic filariasis is caused by the worms *Wuchereria bancrofti*, *Brugia malayi* and *Brugia*

*timori*. These worms occupy the lymphatic system, including the lymph nodes and in chronic cases these worms lead to the disease elephantiasis. Subcutaneous filariasis is caused by *Loa loa* (the eye worm), *Mansonella streptocerca* and *Onchocerca volvulus*. These worms occupy the subcutaneous layer of the skin, in the fat layer. *L. loa* causes *Loa loa* filariasis while *O. volvulus* causes river blindness (Taylor *et al.*, 2005).

Serous cavity filariasis is caused by the worms *Mansonella perstans* and *Mansonella ozzardi*, which occupy the serous cavity of the abdomen. The adult worms, which usually stay in one tissue, release early larvae forms known as microfilariae into the host's bloodstream. These circulating microfilariae can be taken up with a blood meal by the arthropod vector; in the vector they develop into infective larvae that can be transmitted to a new host. Individuals infected by filarial worms may be described as either "microfilaraemic" or "amicrofilaraemic", depending on whether or not microfilaria can be found in their peripheral blood. Filariasis is diagnosed in microfilaraemic cases primarily through direct observation of microfilaria in the peripheral blood. Occult filariasis is diagnosed in amicrofilaraemic cases based on clinical observations and, in some cases, by finding a circulating antigen in the blood (Taylor *et al.*, 2005).

**Signs and symptoms:** The most spectacular symptom of lymphatic filariasis is elephantiasis-edema with thickening of the skin and underlying tissues-which was the first disease discovered to be transmitted by mosquito bites. Elephantiasis results when the parasites lodge in the lymphatic system. Elephantiasis affects mainly the lower extremities, while the ears, mucous membranes and amputation stumps are affected less frequently (Taylor *et al.*, 2005). However, different species of filarial worms tend to affect different parts of the body: *Wuchereria bancrofti* can affect the legs, arms, vulva, breasts and scrotum (causing hydrocele formation), while *Brugia timori* rarely affects the genitals. Interestingly, those who develop the chronic stages of elephantiasis are usually amicrofilaraemic and often have adverse immunological reactions to the microfilaria, as well as the adult worms. The subcutaneous worms present with skin rashes, urticarial papules and arthritis, as well as hyper- and hypopigmentation macules. *Onchocerca volvulus* manifests itself in the eyes, causing "river blindness" (onchocerciasis), one of the leading causes of blindness in the world. Serous cavity filariasis presents with symptoms similar to subcutaneous filariasis, in addition

to abdominal pain, because these worms are also deep tissue dwellers (Taylor *et al.*, 2005).

**Diagnosis:** Filariasis is usually diagnosed by identifying microfilariae on Giemsa stained, thin and thick blood film smears, using the "gold standard" known as the finger prick test. The finger prick test draws blood from the capillaries of the finger tip; larger veins can be used for blood extraction, but strict windows of the time of day must be observed. Blood must be drawn at appropriate times, which reflect the feeding activities of the vector insects. Examples are *W. bancrofti*, whose vector is a mosquito; night time is the preferred time for blood collection. *Loa loa*'s vector is the deer fly; daytime collection is preferred. This method of diagnosis is only relevant to microfilariae that use the blood as transport from the lungs to the skin. Some filarial worms, such as *M. streptocerca* and *O. volvulus*, produce microfilariae that do not use the blood; they reside in the skin only. For these worms, diagnosis relies upon skin snips and can be carried out at any time.

**Concentration methods:** Various concentration methods are applied: membrane filter, Knott's concentration method and sedimentation technique. Polymerase Chain Reaction (PCR) and antigenic assays, which detect circulating filarial antigens, are also available for making the diagnosis. The latter are particularly useful in amicrofilaraemic cases. Spot tests for antigen are far more sensitive and allow the test to be done any time, rather in the late hours. Lymph node aspirate and chylus fluid may also yield microfilariae. Medical imaging, such as CT or MRI, may reveal "filarial dance sign" in chylus fluid; X-ray tests can show calcified adult worms in lymphatics. The DEC provocation test is performed to obtain satisfying number of parasite in day-time samples. Xenodiagnosis is now obsolete and eosinophilia is a nonspecific primary sign.

**Worm lifecycle:** Human filarial nematode worms have complicated life cycles (Fig. 2), which primarily consists of five stages. After the male and female worms mate, the female gives birth to live microfilariae by the thousands. The microfilariae are taken up by the vector insect (intermediate host) during a blood meal. In the intermediate host, the microfilariae molt and develop into third-stage (infective) larvae. Upon taking another blood meal, the vector insect injects the infectious larvae into the dermis layer of the skin. After about one year, the larvae molt through two more stages, maturing into the adult worms (Taylor *et al.*, 2005).

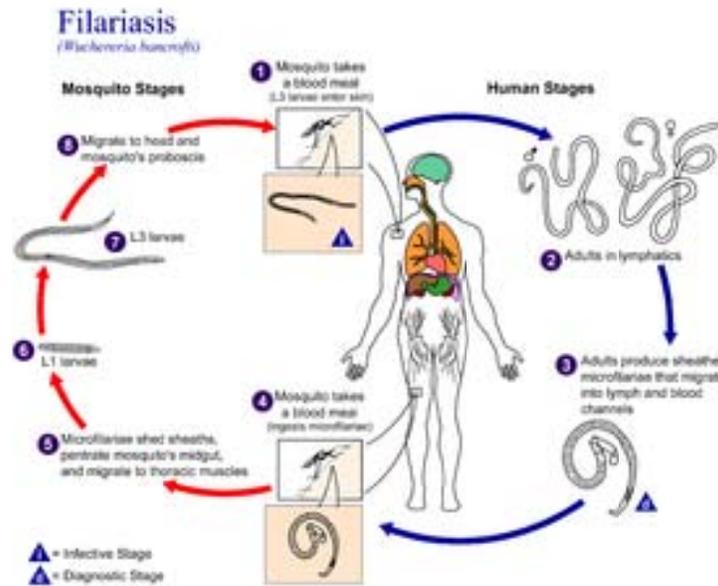


Fig. 2: Life cycle of *Wuchereria bancrofti*, a parasite that causes filariasis, ([http://en.wikipedia.org/wiki/file:filariasis\\_01.png](http://en.wikipedia.org/wiki/file:filariasis_01.png))

**Prevention:** In 1993, the International Task Force for Disease Eradication declared lymphatic filariasis to be one of six potentially eradicable diseases. Studies have demonstrated transmission of the infection can be broken when a single dose of combined oral medicines is consistently maintained annually for approximately 7 years. With consistent treatment and since the disease needs a human host, the reduction of microfilariae means the disease will not be transmitted, the adult worms will die out and the cycle will be broken (Mølgaard *et al.*, 2004).

The strategy for eliminating transmission of lymphatic filariasis is mass distribution of medicines that kill the microfilariae and stop transmission of the parasite by mosquitoes in endemic communities (Mølgaard *et al.*, 2004). In sub-Saharan Africa, albendazole (donated by GlaxoSmithKline) is being used with ivermectin (donated by Merck & Co.) to treat the disease, whereas elsewhere in the world albendazole is used with diethylcarbamazine. Using a combination of treatments better reduces the number of microfilariae in blood. Avoiding mosquito bites, such as by using insecticide-treated mosquito bed nets, also reduces the transmission of lymphatic filariasis (Taylor *et al.*, 2005).

The efforts of the Global Programme to Eliminate LF are estimated to have prevented 6.6 million new filariasis cases from developing in children between 2000 and 2007 and to have stopped the progression of

the disease in another 9.5 million people who had already contracted it. Dr. Mwele Malecela, who chairs the programme, said: "We are on track to accomplish our goal of elimination by 2020." In 2010, the WHO published a detailed progress report on the elimination campaign in which they assert that of the 81 countries with endemic LF, 53 have implemented mass drug administration and 37 have completed five or more rounds in some areas, though urban areas remain problematic (Taylor *et al.*, 2005).

**Treatment:** The recommended treatment for patients outside the United States is albendazole (a broad spectrum anthelmintic) combined with ivermectin. A Combination of Diethylcarbamazine (DEC) and albendazole is also effective. All of these treatments are microfilaricides; they have no effect on the adult worms. In 2003, the common antibiotic doxycycline was suggested for treating elephantiasis. Filarial parasites have symbiotic bacteria in the genus *Wolbachia*, which live inside the worm and which seem to play a major role in both its reproduction and the development of the disease. Clinical trials in June 2005 by the Liverpool School of Tropical Medicine reported an eight-week course almost completely eliminated microfilaraemia (Taylor *et al.*, 2005).

**Epidemiology:** Filariasis is considered endemic in tropical and subtropical regions of Asia, Africa, Central

**In other animals:** Filariasis can also affect domesticated animals, such as cattle, sheep and dogs.

**In cattle:** Verminous haemorrhagic dermatitis is a clinical disease in cattle due to *Parafilaria bovicola*. Intra-dermal onchocercosis of cattle results in losses in leather due to *Onchocerca dermati*, *O. ochengi* and *O. dukei*. *O. ochengi* is closely related to human *O. volvulus* (river blindness), sharing the same vector and could be useful in human medicine research. *Stenofilaria assamensis* and others cause different diseases in Asia, in cattle and zebu.

**In horses:** "Summer bleeding" is hemorrhagic subcutaneous nodules in the head and upper forelimbs, caused by *Parafilaria multipapillosa* (North Africa, Southern and Eastern Europe, Asia and South America).

**In dogs:** Heart filariasis (*Dirofilaria immitis*)

#### CONCLUSION

Schistosomiasis and Filariasis are some occupational diseases in culture fisheries management and practices and need to be managed because of their health implications in aquaculture.

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