

Safe swimming: Prevention of Swimmer's itch

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1. Introduction

The aim of this document or protocol is to achieve a uniform approach to combat swimmers' itch, currently the most common affliction affecting bathers in lakes and unenclosed waters. This is clearly shown by an annual survey held among the Dutch Municipal Health Services (GGDs) and the Provinces to analyse health complaints in connection with recreation in surface waters. In 2000 21 occurrences were reported, 54 in the following year, and this number had risen to 101 in 2002. In approximately half the number of occurrences, skin complaints accompanied by swimmers' itch were the most important causes. Each occurrence in 2001 and 2002 involved approximately 10 bathers with swimmers' itch. It is possible that the number of occurrences and the number of bathers that were involved has been underestimated, because there are reasons to believe that the relatively mild health complaints were not always reported or that a visit to the bathing facility was not regarded as the cause of the affliction. This means that swimmers' itch may be a greater problem than is indicated on the basis of existing statistics.

How to deal with swimmer's itch has not been explicitly regulated in national legislation, which means that no framework exists to deal with the problem. The consequence is that, when it arises, every party deals with the problem with its own means and devices. General inexperience with the problem has resulted in a haphazard approach that is hardly efficient, and as a result of which the wheel is being reinvented over and over again. This protocol is therefore mainly intended to be a document by which the various parties that are confronted with swimmer's itch will establish a procedure to structure the approach to the problem. Moreover, water quality and recreation managers are given the information they need to establish the true extent of the problem and to take efficient measures to combat its cause.

This protocol is not sufficient to eradicate swimmer's itch because the bathing facilities in question are part of the natural water system in which management focuses on optimum ecological functioning in relation to the given functions. This has been laid down in documents such as the European Water Framework Directive, which became effective in October 2000. The parties involved can, however, be called upon the parties involved and held accountable for the responsibilities assigned to them pursuant to laws and regulations.

This protocol was drawn up by the “Swimmer’s itch” study group consisting of:

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2. What is Swimmer's itch

Swimmers' itch is an itchiness that can occur during and after swimming in freshwater lakes, ponds or ditches. The itch is caused by the larvae of parasites that penetrate the skin. These larvae are found freely swimming in the water. They grow in a number of freshwater and appear in warm and sunny weather. Under the influence of sunlight, they swim to the upper water layers where the swimmer can come into contact with them. In The Netherlands, swimmers' itch used to be known as the occupational disease affecting reed cutters and fish farmers.

Swimmer's itch (also called cercarial dermatitis or schistosome dermatitis) is the most frequently occurring complaint when swimming in open water. The uncovered skin can develop an itchy rash (hives) that can greatly vary in size. If the reaction is stronger, patchy red spots can develop around the rash. Once a person has had such a skin reaction, repeated infection can give an even stronger reaction with a headache and a fever. Such a stronger reaction can also occur in the following year. A number of people will need to visit their GP (General Practitioner) for treatment.

The larvae are a development stage of worms that are normally found in water birds. From the parasites' point of view, the larvae accidentally end up on human skin. As they cannot develop further in that environment, they die on the skin. The hives and the occasional large red patches are the human body's reaction to dying and dead larvae.

In water birds they penetrate the bodies deeper and ultimately, depending on the species, they can be found in the blood vessels near the gut or the nasal cavity. The eggs end up in the water via the excreta of the birds. The larva (miracidium) which hatches goes actively in search of a suitable fresh-water snail. This larva is not infectious for human beings. The parasite goes through a complex development in the snail, ultimately resulting in some thousands of new larvae

Parasites depend on hosts for their development and growth. They cannot develop without them. For their development cycle, the parasites that can cause swimmers' itch need both a definitive host and an interim host. They include species belonging to the Trichobilharzia family (Schistosomatidae family, Trematoda class or trematodes), which can be found as adult worms in their definitive hosts being water birds such as duck species and cormorants (Figure 1). Their eggs end up in the water via excreta. The eggs develop into larvae, the miracidia, which actively swim around in search of a suitable interim host: the fresh-water snail. In these snails, sporocysts develop in which larvae (cercariae) grow. They move right through the snail tissue to reach the outside world. The speed at which they develop depends greatly on the water temperature. Particularly in warm, sunny weather, the cercariae leave their infected snail in their thousands. The cercariae actively swim towards the light and reach the upper water layers where they are most likely to find a suitable definitive host to penetrate, young water birds in particular. That is where they develop into adult trematodes to complete their life cycle.

(cercariae). These larvae have now become infectious when they 'accidentally' come into contact with human skin. They really should find young ducks.

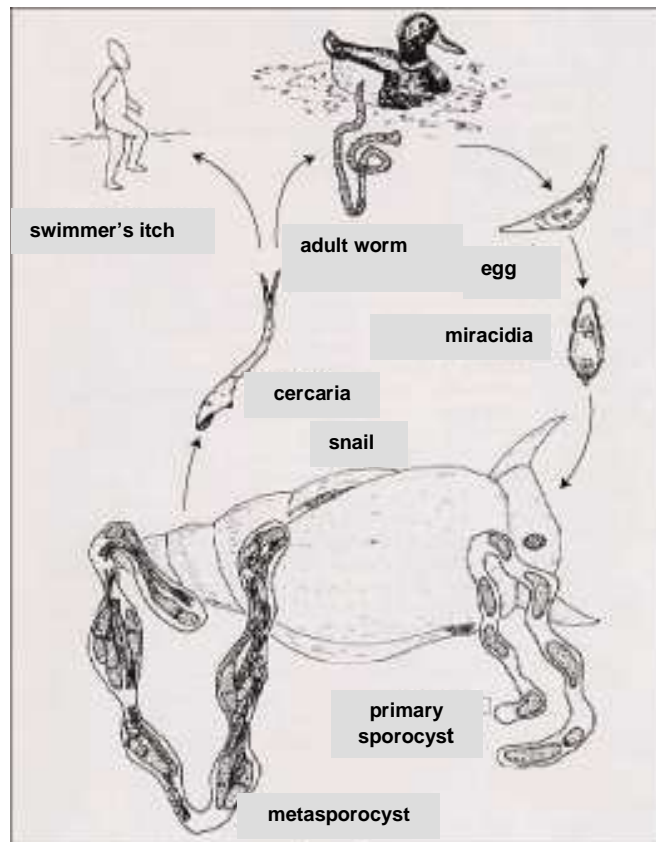
Swimmers' itch is therefore caused by parasites that have reached the water via snails. When swimmers' itch becomes apparent, we know that the initial phase was already formed in the previous bathing season. We are being confronted with the results of a parasite developing in the snail, which process started in the previous year.

Once you have caught swimmer's itch, only the itch can be treated. It is therefore important that measures are taken to prevent swimmer's itch. The affliction can only be combated by taking preventive measures. Once cases of swimmer's itch have been reported, the path to take is to try to prevent new cases.

It goes without saying that efforts to combat swimmer's itch or in actual fact the preventive measures taken, should be focused on the host snails. If, however, it is not possible to prevent new cases of swimmer's itch by taking preventive measures, the bathing water can lose its 'suitable for swimming' designation; this may be temporary or permanent. Without water recreation no swimmer's itch. Once the diagnosis swimmer's itch has been established in a water and that information has been made public, not very many swimmers will be eager to go there.

Figure 1

Schematised life-cycle of bird schistosomes
(source: Sluiter, J.F., 1983. Parasite-host relationship of the avian schistosome *Trichobilharzia ocellata* and the hermaphrodite gastropod *Lymnaea stagnalis*. Doctoral thesis, Vrije Universiteit, Amsterdam)



This protocol gives an outline of how swimmer's itch can be combated through actions according to a 'safety chain' approach from the moment bathing water is suspected of being unsafe.

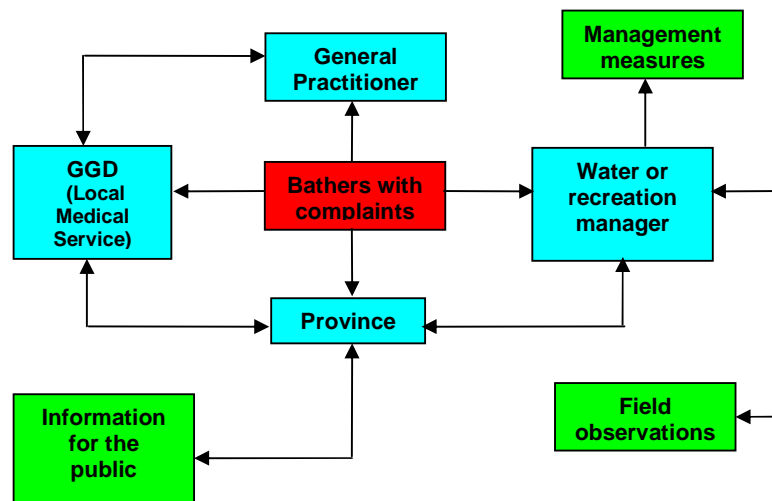
3. Safety for the bather

There is always a risk of contracting swimmers' itch when recreational activities are undertaken in inland surface waters. The risk can be reduced, however, by taking preventive measures. Working according to a 'safety chain' makes it possible to approach the problem in a structured way. Such safety chain includes the following steps:

1. Proaction (preclude infections): by refraining from designating a particular water area as a bathing facility or, for example, by withdrawing that designation. Such a decision can only be made when a risk profile indicates that the risks are too great.
2. Prevention (prevent infections): by catching and removing the host snails before or during the bathing season.
3. Preparation (prepare controls measures): the preparation of control measures, such as implementing the monitoring programme (mapping out host snail populations).
4. Repression (fight the problem): taking measures aimed at combating the source of the problem. This means catching host snails, i.e. the potentially positive aquatic snails. Examples of public measures are: information, advice and prohibition.
5. After care: medical care and preparing for possible proactions.

It is not only important that the links in the safety chain connect well, but also that the activities are structured. The latter is particularly important when swimmer's itch has been established in a bathing facility and quick action must be taken to protect bathers. It is therefore essential that the communication lines are clear and that the desired actions are carried out properly (Figure 2). Further detailed proposals for necessary actions are addressed in the chapter on 'Management & Control'.

Figure 2
Diagram of communication lines (blue)
and actions (green)



4. Reporting of complaints

People with swimmer's itch can report their complaints to the following places or to the following persons:

- the GP (General Practitioner);
- the GGD (Local Medical Service);
- the recreation manager of the bathing facility;
- the water quality manager;
- the provincial authorities.

It is important that all reports are sent to a central provincial reporting station by means of a complaint form, irrespective of where the complaints were initially reported. To be able to assess the complaints, the provincial authority will ask advice of both the GGD and the water quality managers. This is necessary because, when swimmers' itch is reported by bathers, it is not always possible to track down infections in the host snails. At the same time it is also possible that positive host snails will be found in the bathing facility before bathers report complaints.

If there is a health risk, the provincial authorities can decide to erect warning signs. In extreme cases, the province can decide to close the relevant water for water recreation. It is the intention, however, that timely preventive measures will render this unnecessary.

The role of the various parties with respect to the identification and prevention of swimmers' itch can be described as follows:

1. GP

When the diagnosis is positive, it is important that the GP together with the patient checks where he has most probably contracted the swimmer's itch. Not only the name of the recreation water is important, but also the place(s) where the patient has been within the relevant area. This information is part of the report to the GGD.

2. GGD

The GGD determines, just as the GP has done, a diagnosis for the bathers with complaints. In addition, a general assessment of the problem is carried out on the basis of pattern of complaints, where possible together with data about the presence of positive host snails in the bathing facility. The GGD also advises the province about assessing the complaints and imposing measures. Wherever possible, it is useful to include a risk profile of the bathing water in question in the advice.

3. The Health Care Inspectorate (IGZ)

Formally, the Health Care Inspectorate (IGZ) has an advisory task ensuing from Article 36 of the Public Health Act (1956) which sets out the following: 'to carry out research into the state of public health and its determinants and also, where necessary, to point out and promote means to improve the foregoing'.

4. Province

The province fulfils a central role in the protection of bathers against the risks of swimming in open water. Its tasks are:

-
- a. to draw up a swimmer's itch risk profile for bathing waters;
 - b. to notify the water quality manager of any reported occurrence of swimmer's itch and to ask him to take measures;
 - c. to inform the manager of the bathing facility about preventing swimmer's itch and to ask him to take preventive measures;
 - d. to supervise observance of the preventive measures;
 - e. together with de GGDs and the water quality managers of the bathing facilities to inform and warn the public by various methods (newspapers, teletext service, internet sites, warning signs, for example);
 - f. if necessary, to inform the public about the risks connected with bathing in open water;
 - g. to evaluate all activities regarding swimmer's itch with all parties involved on an annual basis.

5. Municipality

The municipalities/GGD's have an advisory role vis-à-vis the provinces.

6. Water quality manager

The water quality manager carries out targeted field and laboratory studies into the prevention of the cercariae that cause swimmer's itch and he can take action against these cercariae (Chapter 5).

7. Recreation manager of the bathing facility

It is the manager of the bathing facility's responsibility to take measures to combat swimmer's itch, as described in 'Management & Control'. The water quality manager will have to ensure that these measures do not lead to a deterioration of the water quality.

5. Management & Control

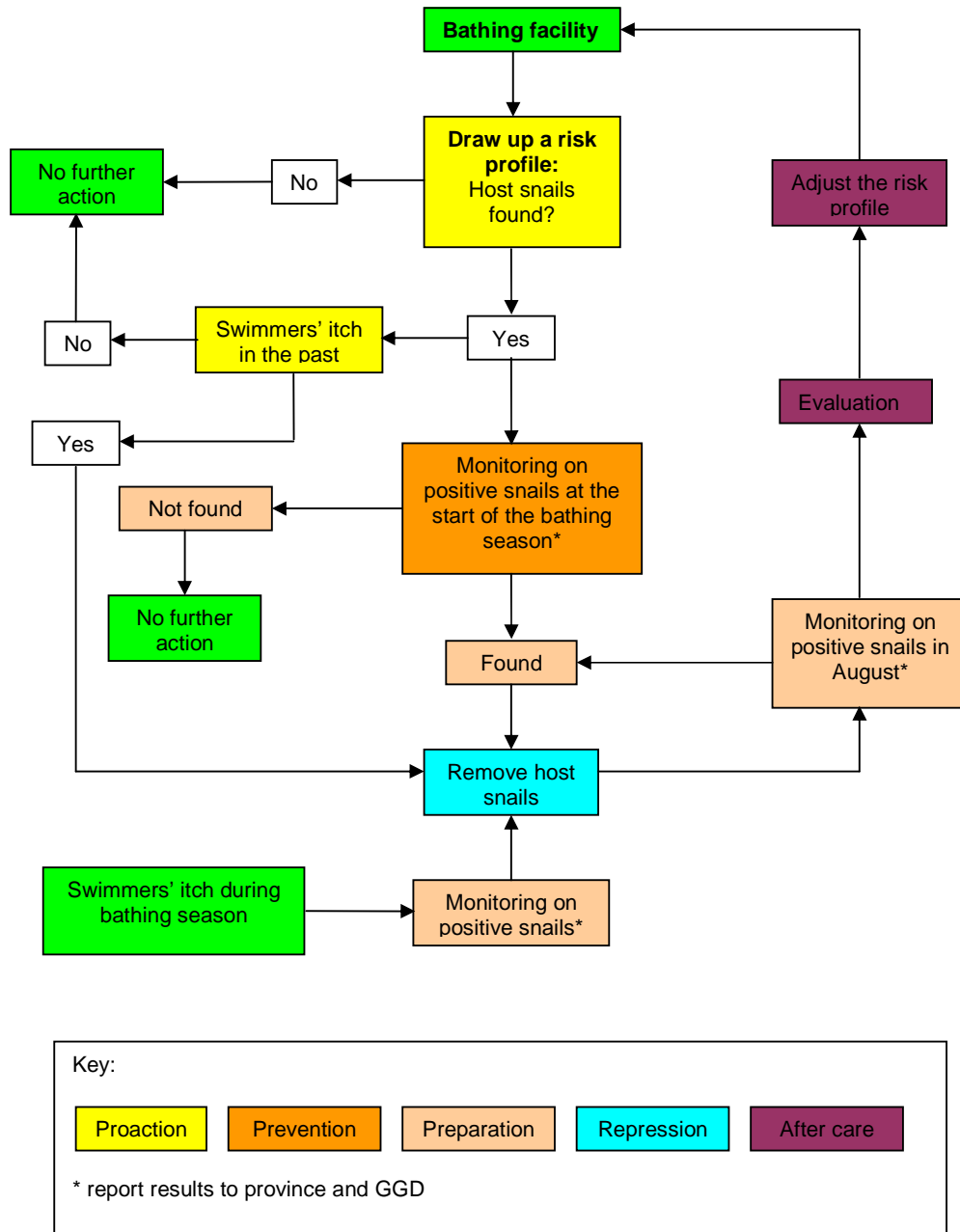
The provincial authority fulfils a central role in the protection of bathers against the risks of swimming in open water. It goes without saying that they will take the lead in coordinating any management and control activities. This means that they must take the initiatives necessary to resolve the complaints. Depending on the extent of the problem and the locations where the problems have occurred, each province will organise its own specific system.

To manage and control the swimmer's itch problem, it is important that it is quite clear who is responsible for what. It is essential that every province comes to a purposeful approach to the problem based on its own responsibilities and in close mutual consultation with the other parties involved. The responsibilities can be summarised as follows:

Actors	Responsibilities
<i>Province</i>	a. Coordination of management and control b. Implementation of measures
<i>Water quality manager</i>	a. Monitoring of bathing water quality b. Advice on management c. Implementations of measures
<i>Recreation manager</i>	a. Implementation of measures
<i>GGD</i>	a. Establish a diagnosis b. Identification c. Advice

The management and control of the problem can only be effectively implemented when an integrated chain of actions (Figure 3) is completed, on the one hand consisting of measures on the other on establishing its effectiveness. To prevent a new outbreak of swimmer's itch in bathing waters, it is important that these actions take place each year.

Figure 3
The safety chain for swimmer's itch



The safety chain (Figure 3) includes the following steps:

1. Proaction: Analysis of risk factors

The water quality manager must draw up a risk profile for each bathing water on the basis of the possible presence of host snails in which cercariae are able to develop. At the same time, the use of the bathing water as feeding or breeding places for water birds is an important factor.

2A. Prevention: draw up or adjust the monitoring programme

The monitoring programme as carried out by the water quality manager must be aimed at collecting field data in such a way that the extent of the problem can be assessed. The frequency of the monitoring depends on the risk profile of the bathing water: the stronger the profile the higher the frequency. The following items should always be included in the monitoring programme.

- a. a host snail inventory;
- b. a check of host snails for the presence of ocellate furcocercariae;
- c. a report of the monitoring results to the province and the recreation manager of the bathing facility.

It is recommended to add advice about preventive action against swimmers' itch to the report mentioned under c.

2B. Prevention: carry out field observations

Field observations can be limited to surface waters with sufficient transparency (>1 m). In such waters, the host snails need to be checked for the presence of positive snails. As far as a choice of surface waters is concerned, it is possible to limit action in the larger lakes to places where water recreation takes place.

The snails can be collected with the aid of a hand net (mesh size 5 mm) in accordance with the regulation 'Method for monitoring bathing water regarding the prevention of cercariae that cause swimmers' itch' (Appendix 1).

5A. Preparation: monitoring the collected host snails

The most important species of host snails belong to the Lymnaeidae family (pond snails) such as *Lymnaea stagnalis* (great pond snail), *Stagnicola palustris*, (marsh pond snail), *Radix auricularia* (European ear snail) en *Radix ovata* (oval pond snail). To get an idea of the severity of the problem, it is necessary that individual snails of each of the abovementioned species is checked for the presence of ocellate furcocercariae by stimulating their release. The shell height of each positive snail must be measured. The presence of ocellate furcocercariae is verified with the aid of a microscope, because snails may carry different types of parasites but only ocellate furcocercariae cause swimmers' itch. A detailed instruction is given in appendix 1.

5A. Repression: taking measures against swimmers' itch

The most important measure is to remove the host snails from the bathing zones¹. This can be done with coarse-meshed hand nets (mesh width <5 mm) (Appendix 2).

Another option that needs consideration is providing information to the public about risks at bathing facilities. This can also mean that warnings are given or, in extreme cases, that the bathing water is closed. In addition, general practitioners can be informed.

The effectiveness of the measures can be monitored by carrying out supplementary field observations and by analysing the collected host snails.

¹ This measure should be used with due care. The water quality manager will have to take the ecological functions of the bathing water into consideration. Removing the snails should be limited to the pond snails (Lymnaeidae) unless it is clear that other species can also cause swimmers' itch. The use of pesticides (molluscicides), planting fish or removing vegetation must be strongly advised against.

A warning (at the bathing facility itself) can be lifted when changed circumstances make this possible. This is when experts have carried out an evaluation of the preparatory and repressive measures:

- a. there are no more positive snails;
- b. there are no more reports about swimmers' itch.

When providing information, it must be made clear that - after measures in the repressive stage have been taken and any warning signs have been removed - although the risk of contracting swimmers' itch may have decreased a great deal, it is never certain that the risk of swimmers' itch has been eradicated from a particular bathing facility for that season.

5A. After care: medical instruction

Bathers who have contracted swimmers' itch can be referred to their GPs for treatment..

5B. After care: preparation of proaction, reports and evaluation (annual)

The problems of the bathing facilities must be evaluated annually as soon as possible after the bathing season. The purpose of the evaluation must be:

- a. to check whether the monitoring programme needs any adjustment;
- b. to check whether the measures taken against swimmers' itch have been sufficiently effective;
- c. the preparation for the proaction stage and the considerations that can play a part in that.

When, during the bathing season, swimmers' itch is reported at a bathing facility which has not reported swimmers' itch before, the safety chain can be started from the preparatory stage.

5.1 Swimmer's itch but no positive snails

It is possible that bathers report swimmers' itch without there being any proof of the presence of positive snails in the bathing facility in question. There may, however, be occurrences of potential host snails. If this should be the case, the safety chain (Figure 3) must be run through starting with "swimmers' itch during the bathing season". This means that after the preparatory stage, which has been run through already, the repressive stage (removal of host snails) must be started as soon as possible.

6. Statutory frameworks

When a surface water has been designated as 'bathing water', as regulated in the Water Management Act, the following laws and regulations must be observed:

1. Bathinghouses & Swimming Pools (Hygiene and Safety) Act (Whvbz)

The provinces are charged with the implementation of this act. Among other things, the act monitors compliances with safety and hygiene, such as water quality, of bathing facilities in surface waters. With reference to the transmission of infectious diseases, the GGD is consulted for advice in all circumstances. The province takes this advice extremely seriously.

2. Infectious diseases Act (IW)

The GGDs are charged with the implementation of this act on behalf of the municipalities. Swimmer's itch is not mentioned in this act. In general, it can be said that only diseases of an epidemic nature fall under this act.

3. Collective Prevention of Public health Act (WCPV)

This act regulates the tasks and powers of the municipalities in the domain of prevention against diseases including infectious diseases. The GGDs have an advisory task in this respect.

4. Water Management Act (Wwh)

The Whvbz refers to articles 5, 7 and 10 of the Wwh. These articles that are connected with the functions vested in surface waters.

5. Pollution of Surface Waters Act (Wvo)

The water quality managers are charged with the implementation of this act. If a water has been assigned the function of bathing water, pursuant to the Quality objectives and Monitoring of Surface water Decree (Bkmo), the managers are obliged to monitor the water quality in accordance with the specified parameters. However, swimmers' itch is not included in the set of parameters.

A large number of pathogens can occur in open waters² that are not included in the water quality monitoring prescribed in the Wvo/Whvbz. This also applies to organisms that cause swimmers' itch. This means that in respect of these pathogens there are no quality standards against which the bathing water can be qualified as suitable or unsuitable. With reference to swimmers' itch, this protocol aims to close this loophole as much as possible.

It is important that complaints are investigated rapidly and that the necessary information is sent quickly to the appropriate organisation. It is therefore of extreme importance that communication between the provinces and the GGDs works very well. Within the framework of the

² What is meant here is all fresh surface waters

Wvo, the primary responsibility for the quality of the water lies with the water quality manager (the Water Boards, the Department of Transport, Public Works and Water Management, etc.). The province has a supervisory role in matters regarding water quality, hygiene and safety (laid down in the Whvbz); the GGD advises the provincial and municipal authorities on aspects of health (laid down in the IW and the Wcpv).

If a considerable number of bathers swim in a water that has not yet been assigned the function of bathing water – because this had not been explicitly prohibited – this protocol can also be used if swimmer's itch should occur in that bathing water.

7. Evaluation of measures taken

It is important to evaluate the occurrence and the prevention of swimmer's itch with all parties involved. The initiative to be taken for the evaluation lies with the province. The aim of the evaluation is to improve the approach to the problem by:

- a. checking the functioning of the safety chain and, if necessary, improving it (among which the consequences for the proaction);
- b. checking the functioning of the communication chain (Figure 2) in order to improve it, where necessary;
- c. monitoring whether actions have been carried out on time and to a sufficient degree;
- d. documenting – uniformly and unambiguously - all information regarding the problems;
- e. checking whether the public has been sufficiently informed.

8. Supplementary information

For supplementary information, reference can be made to the following Dutch language sources:

1. Internet sites

- a. <http://www.infectieziekten.info/index.php3>
- b. <http://www.rgv.nl/framepaginas/waterkwaliteit.htm>
- c. www.infectieziektenbulletin.nl

2. Reports

- a. Gezondheidsraad (National Health Council), 2001 Microbiële risico's van zwemmen in de natuur (*Microbial risks of swimming in natural waters*). Report Gezondheidsraad, The Hague no. 2001/25.
- b. Landelijke Coördinatiestructuur Infectieziektebestrijding, 2002 (*National Coordination Structure for Combating Infectious Diseases*). Planning document for diseases linked to recreation in and around bathing water. Report by the Landelijke Coördinatiestructuur Infectieziektebestrijding, Utrecht (*National Coordination Structure for Combating Infectious Diseases*).

3. Publications

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Leenen, E.J.T.M. & A.M. de Roda Husman, 2004. Gezondheidsklachten in verband met recreatie in oppervlaktewater in de zomers van 2000, 2001 en 2002. (*Health complaints in connection with recreation in surface water in the summers of 2000, 2001 and 2002*). Bulletin Infectieziekten 15 (5) 178-183.

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Appendices

Method for monitoring bathing water for the presence of cercariae that cause swimmer's itch

1. General

To collect information on the presence of cercariae causing swimmers' itch, it is recommended to focus the monitoring on the presence of the parasites in the following species of pond snails: *Lymnaea stagnalis* (great pond snail), *Radix ovata*³ (oval pond snail), *Radix auricularia* (European ear snail) and *Stagnicola palustris* (marsh pond snail) (Illustration 1). Most of these species are commonly found in the fresh inland waters.

Snails already become infected at a young age. Under the influence of parasites, the snails can grow slightly larger than normal ("giant growth"). As the snails are larger they can also have more cercariae. It is therefore always important to check the largest snails first.

2. Safety

When collecting snails, the following safety regulations must be observed:

1. avoid contact with the bathing water (don't pick up snails with bare hands);
2. wear wading trousers or waders;
3. always have sufficient information regarding the depth of the bathing facilities to be monitored and the type of sediment (sinking / sucking).

3. Collecting snails

The parasite winters in the snail. During the winter months, their development stagnates. The development of cercariae is positively correlated to the water temperature. As the water gets warmer, the parasite grows faster. In a suitable water temperature, a positive snail will continuously produce cercariae until it dies. This means that the time of sampling is not too critical. In a relative warm spring, it is possible that the first cercariae will appear during May; in general, the period which young ducks are present.

Snails can best be collected on a sunny, windless day which makes them clearly visible in the littoral zone to which they have migrated. Use a net or sieve so that the individual snails can be fished from the water directly. You can use a standard macrofauna net (EN standard 27828: 1994 Water quality - Methods for biological sampling – Guidance on hand net sampling of benthic macroinvertebrates), but a household sieve attached to a stick is also suitable.

The snails are transferred to a jar which is half filled with water. Water plants that were collected with the snails need to be removed first. Snails

³ In some waters *Radix peregra* (wandering pond snail) can also be found. This is also a highly suitable interim host. The difference between *R. ovata* and *R. peregra* is not always clear. On the basis of the current views of taxonomy and the distribution of the two species, the conclusion can be drawn that *R. ovata* is the most common in the Netherlands.

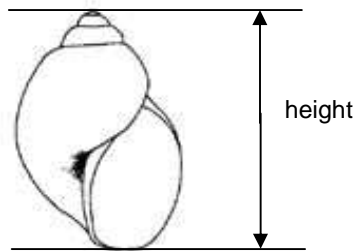
on vegetation must be rinsed off the vegetation in a bucket or plastic container.

In general, the percentage of infected snails is relatively small (<2%). This means that, if possible, at least 50 to 100 snails with a length of 10 mm or over must be collected before it can be determined with any certainty whether complaints are caused by cercariae that cause swimmers' itch.

4. Checking snails

Before checking the snails for the presence of cercariae (for a list see paragraph 1), they must be identified first. With the aid of illustration 1, most species can be named. When in doubt, with juvenile snails, for example, a list of generic names may suffice.

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Figure 1
Height of snails



For greater clarity of the question from which shell height snails could be positive, it is important to measure each individual snail before checking them for the presence of the cercariae that cause swimmers' itch. What exactly is meant by the height of a shell is shown in figure 1.

The collected snails are checked while they are still alive. Per species, 10 snails are first put into a 1 litre glass jar, after which it is half filled with tap water. The jar is then placed in the direct light of a lamp. When, after approximately two to three hours, the cercariae can be observed in the jar, they are checked with the aid of a microscope (100x) to check whether these cercariae are indeed ocellate furcocercariae. Most cercariae are produced during the morning. This means that the checking should preferably take place in the morning. If any ocellate furcocercariae are found in a jar, the procedure must be repeated with the individual snails in the jar to identify the number of positive snails.

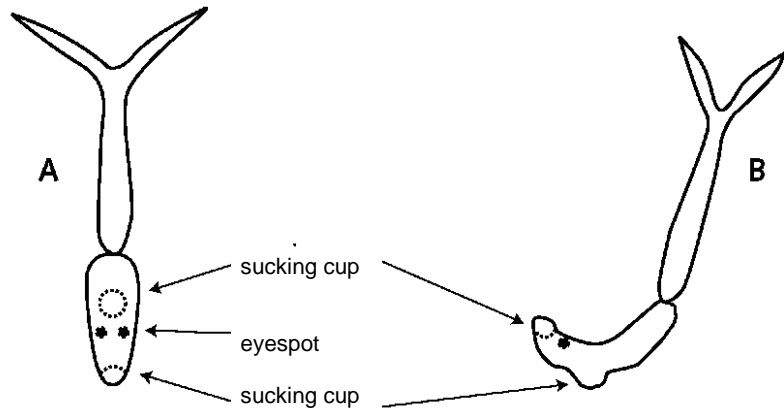
5. Identification of cercariae

Ocellate furcocercariae consist of a head section and a tail section. The head has two eye spots and two suction cups. The tail is forked (Figure 2). The head is approximately 0.30-0.35 mm long and 0.07-0.08 mm wide. The tail section is approximately 0.45 mm long and has a width of approximately 0.05 mm. The above dimensions can vary widely. The ocellate furcocercariae move very actively; when at rest they assume the characteristic 'walking stick form' (Figure 2B).

Figure 2

An ocellate furcocercariae

- A. View from above
- B. In tranquility (side-view)



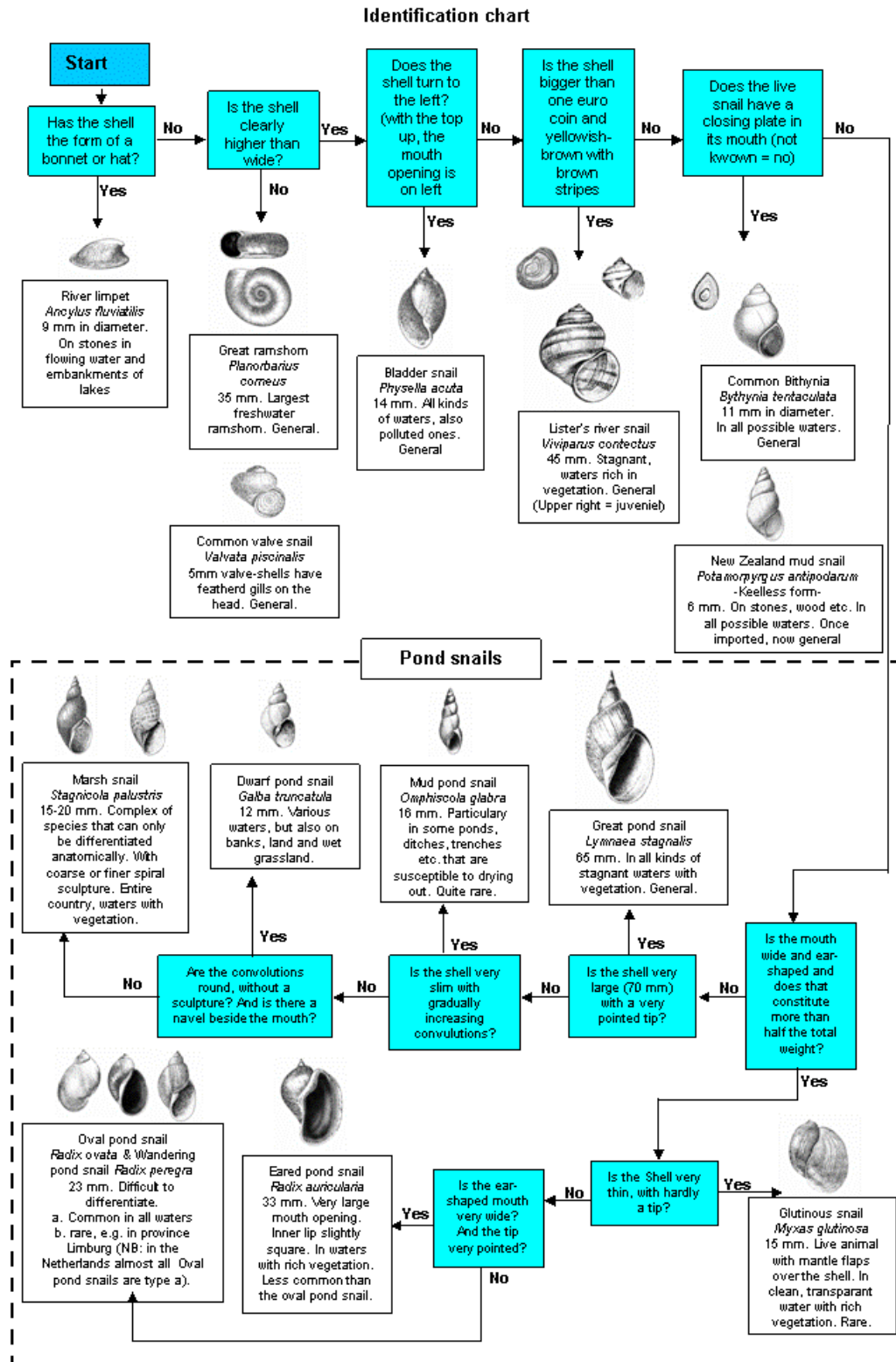
6. The field form

A field form must be filled out for each sample. An example of a field form is shown below.

Field form

Area:	Sample number
Subarea:	Sampler:
Date of sampling	
Description of location:	Weather data:
	Cloudiness: /8
	wind: Beaufort
Water temperature	°C
Transparency:	Dm
Notes	

Illustration 1
Chart for identification of freshwater snails



Appendix 2

The removal of host snails

The best time to remove host snails is on a sunny and windless day in spring (from the beginning of May). Under influence of the sun-rays, the upper layer of the water warms up as a result of which the snails migrate to the littoral zone. The way the snails can be removed from this part of the embankment zone depends largely on local circumstances. In many cases it is sufficient to attach a hand net or a household sieve to a broom stick or something similar. With relatively large surfaces (beaches, for example), it is recommended to use towed nets (trawl net, for example), possibly with a tickler chain. The mesh gauge of both types of nets should preferably not exceed 5 to 6 mm. When a hand net is used the width can be at least 50 to 60 cm. A towed net can be much wider, a width of at least 1.5 metres seems ideal.
