

The Science of Felt - 2009

A look at the science driving the move to eliminate the use of felt soled waders

Bob Wiltshire

Center for Aquatic Nuisance Species

In September 2008, Trout Unlimited called for the elimination of felt soles on wading boots by 2011. Just a week later, Simms Fishing Products introduced a new line of felt-free boots and announced that, beginning in 2010, they would no longer sell felt soles. These actions came from increasing concerns that felt soles were providing a perfect home for transporting invasive species. In fact, New Zealand had already announced that they were banning the use of felt soled boots beginning October 1, 2008. Since that time additional felt bans enacted (SE Alaska beginning January 1, 2011) and most wader companies have added felt-free alternatives to their product line.

The response from the fishing community to these actions has been mixed. Many anglers are embracing the new boots and believe if protecting our waters means giving up felt they are fine with the trade. Others are not so accepting, citing cost and the belief that the new waders don't work as well in certain water types as reasons they oppose the switch. Recently, the science that underlies the movement to eliminate felt has been questioned. There are some who believe; anglers are being coerced into buying new boots based on no or flawed science, that there is no proof that anglers are moving invasives and that there is no proof that felt is worse than any other part of a boot.

In fact, there is sound scientific evidence that anglers are moving invasives and that felt is much worse than any other part of a boot or any other fishing equipment.

To understand how we got to a point where the perceived science is so different from the actual we need to back up and look at what put the focus on felt in the first place. The single biggest factor was the rapid spread of didymo in New Zealand. Didymo, *Didymosphenia geminata* is a single celled algae that is causing significant impacts to pristine trout waters worldwide. Native to the Northern Latitudes, didymo was not historically a significant problem. However, following its introduction to New Zealand in the early 2000's it quickly became a significant ecological and economic problem.

In 2006, The Federation of Fly Fishers hosted an international didymo conference where experts discussed what was known and unknown about this invader. There was considerable discussion about how didymo was being spread and the conclusion was that didymo cells were being transported by anglers. Based on the best science available at the time, researchers speculated that other parts of wading boots might actually be of more concern than felt soles. Conference attendees knew that as they were meeting additional research was being conducted that would provide more answers about transmission on boots.

A didymo white paper was published based on the conference presentations. This paper <http://stopans.org/Presentations/ScientificKnowledgeofDidymo.pdf> is the best summary of didymo information available but only contains information gathered prior to 2006 and does not contain newer research results. The claims we hear today that there is no science to justify a felt ban result from the information reported at the 2006 conference and not the results of research conducted since then. So, what have we learned since 2006?

Do Anglers Move Didymo

Unless the actual first introduction of a new invasive species is observed it is difficult if not impossible to determine how it was first introduced. As Didymo has spread around the world we know when new discoveries are made but lack direct proof of how it got there. Scientists are studying this problem and two recently published studies give us a better grasp of how anglers are likely spreading invasives.

In 2007 at Montana State University, graduate student Kiza Gates published the results of her study of the potential for angler movement of whirling disease (WD) <http://etd.lib.montana.edu/etd/2007/gates/GatesK0507.pdf>. In the course of her research she studied anglers' waders to determine the probability of their transporting WD and discovered that the average angler who does not clean their boots is transporting 16.78 grams (.59oz) of sediment from one access site to another. The amount of sediment was the same for people arriving at a site and leaving a site which means that anglers are moving sediment between waters. Doing some very basic calculations, she determined that in 2005 angler boots moved more than 6,300 pounds of sediment between access sites in Southwestern Montana. Additionally, she calculated that non-resident anglers carried more than 1,600 pounds of sediment into and out of Montana.

The next question she looked at was if WD was being carried between sites in this sediment. Unfortunately, the level of technology available did not allow her to answer the question for WD. However, a New Zealand mud snail was discovered in the sediment recovered from one boot which shows that invasive species are definitely being transported in the sediment carried on waders.

Thus, we know that anglers can transport didymo in this fashion. But, is it being transported this way? Canadian researcher Max Bothwell and his collaborators have examined the spread of didymo on Vancouver Island to try and determine how the species is spread. Although they do not have actual observations of anglers causing new introductions, they concluded that "*the pattern of didymo spread among rivers on Vancouver Island correlates with the activity of fishermen and the commercial introduction and widespread use of felt-soled waders in the late 1980s*"

They present the complete results of their work in a scholarly article published in *Fisheries* <http://www.env.gov.bc.ca/wat/wq/studies/didymo-blooms.pdf>. In the course of their research they noted a significant relationship between the presence of didymo and the presence of anglers. They particularly note rivers in which didymo is not found upstream of angler access points and rivers that are closed to fishing that are surrounded

by didymo but remain free of it. They reference a number of other well documented examples from around the world that illustrate the connection between wading anglers and the spread of didymo.

Why Focus on Felt?

With overwhelming evidence that fishing boots are spreading invasives the attention has turned to how to minimize the risk that anglers are transporting didymo. Research has shown that there are some practical options for killing didymo on fishing equipment <http://www.biosecurity.govt.nz/files/pests/didymo/didymo-decon-feb-05-rev-aug-06.pdf>. Heat, cold, drying and exposure to chemicals are all effective at killing the algae so the issue becomes, how does an average angler achieve the lethal levels for any of these methods?

When researchers looked at this question it became obvious that felt presented disinfection problems that other materials did not. The main reason for this is the nature of the felt material. Felt is constructed as a dense mat of randomly woven fibers. It has large interstitial spaces that can be a perfect trap for any small material. Gates, in the study referenced above, did extensive work to determine the relative ability of various wader materials to trap WD spores. In her experiments, felt trapped 100% of the WD spores that it was exposed to while rubber trapped none. This is dramatic evidence that felt soles present a much greater risk of transport than rubber soles.

However, as already noted, there are effective methods for killing didymo and it is logical to assume that felt can be disinfected using these techniques. Unfortunately, research from New Zealand shows that disinfecting felt soles is much more difficult than might be expected. Quite simply, the nature of the felt material is such that live didymo cells could easily penetrate the interior layers of the felt soles but treatment methods for killing didymo are ineffective at disinfecting these inner layers. Thus, even after following recommended decontamination procedures, it was likely that felt soled boots were still spreading didymo.

In their paper titled *Studies on the survivability of the invasive diatom *Didymosphenia geminata* under a range of environmental and chemical conditions*, <http://www.biosecurity.govt.nz/files/pests/didymo/didymo-survival-dec-06-rev-may-07.pdf> the researchers fully document their results. In their experiments felt soled boots that were examined 5 hours after use in infested waters contained nearly 3,000 times more live didymo cells than rubber soles (11,000 on felt vs. 3.9 on rubber). At 36 hours, a second careful cleaning yielded significant numbers of live cells from the felt soles and no live or dead cells from the rubber soles (290 on felt vs. 0 on rubber). We should note here that both leather shoe uppers and neoprene materials also held live cells at 36 hours but at much lower levels than the felt.

Careful experiments were then conducted to judge the efficacy of the various treatments for killing all of the live cells that might be trapped on waders. The results showed that most of the recommended treatments were effective at killing all of the cells found on most parts of the boot but that felt soles were an exception and it was difficult to achieve a complete kill of didymo trapped in felt soles. Specifically, the authors concluded:

- Felt soles present a greater risk of transfer than the other materials tested.
- Soaking in a disinfectant solution is far more effective than spraying (spraying was deemed to be totally ineffective)
- Even after 20 minutes of soaking, the disinfectant does not fully penetrate all areas of the felt sole
- Complete drying of felt soles is very difficult – soles can remain damp for weeks
- Heating the boots to 45°C (113°F) for at least 20 minutes will disinfect the soles

Based on the results of this research New Zealand determined that felt represents a unique threat that could only be adequately addressed through a complete ban. That ban is now in place and all New Zealand anglers are now felt free. With an Alaskan felt ban already approved and other US felt bans being considered we can expect that the move to eliminate felt will grow quickly.

What Does This Mean for Anglers

There is well documented scientific proof that felt represents a special problem in wading boots. Although many boot parts are capable of trapping and carrying aquatic invasive species (AIS), the difficulties of disinfecting felt make it very different from the rest of the boot parts. While the elimination of any boot part that could trap or transport AIS is beneficial and should be encouraged, the move to eliminate felt is a prudent and appropriate response to the threat it poses.

We need to recognize that much of the motivation for eliminating felt is focused on didymo. An argument can be made that felt only matters when the invasive species is microscopic and that any larger invader will be on the surface of the felt where it can be removed or killed. In fact, this is true. If the organisms are on the surface of the felt they can be eliminated. However, didymo is only one of our microscopic invaders. It has already been demonstrated that felt can easily trap and transport whirling disease spores and we must be realistic and recognize that there are likely new microscopic invaders still to come. Thus, it is only prudent that we move away from felt.

The debate over the effectiveness of rubber soles verses felt will continue to rage and there is no doubt that some anglers will insist that their recreational desires should take precedence over the resource issue. However, the move to eliminate felt is based on conclusive scientific proof that it represents a special threat. Companies, organizations and agencies are all accepting of this and the move away from felt will continue to grow. Anglers may not like the change and some will be vocal in their opposition. However, we should all make sure that any argument is based on sound science. The science shows that felt is a special problem and anyone disputing that has nothing to back their claims.

Finally, we must realize that felt is only one part of the problem. As already mentioned, there are many other places where invasives can be trapped and transported in our boots and other gear. We must adopt new habits that include careful cleaning after each use. While switching to felt-free waders is a good thing, it is just one step in the process of becoming a clean angler. Any one of us could be the person to carry an invader to a new water and none of us wants to be that person. Inspect, Clean and Dry your gear after each use and you will help to protect the resource that we all depend upon.

Unfortunately, increasing numbers of anglers are hearing the argument of no science and angler manipulation and some are passing it on as truth to others. This provides an excuse to anyone who wants to avoid switching to felt-free boots and erodes public confidence in fishery managers and science

The Center for Aquatic Nuisance Species (CANS) is dedicated to reducing the human caused spread of aquatic invasive species. CANS is responsible for the Clean Angling Pledge and other programs that engage anglers in active efforts to protect our resources. CANS is a 501c3 non-profit organization based in Livingston, MT. For more information visit www.cleanangling.org.

Center for Aquatic Nuisance Species
215 East Lewis St, #201
Livingston, MT 59047
406-222-7270
info@stopans.org