Figure 1: The white, fluffy fungal infection of *Saprolegnia*, tends to be a secondary infection on open abrasions and sores

Home Sweet Home

A guide to some of the creatures that call a trout's body home,

by Dr. Chris Williams and Shaun Leonard.

Parasites are natural components of healthy aquatic ecosystems. They have evolved to infect most living organisms and exist in wide ranging environments. Consequently, parasites are everywhere.

Over 50 parasite species have been recorded from UK trout populations, ranging from microscopic protists to tapeworms the length of your hand. Some live on a single fish, whilst others have complex life cycles with multiple hosts, spanning many years and travelling hundreds of miles before they mature and reproduce.

Many parasites lead a benign existence, tolerated by healthy fish without causing any obvious distress. However, by their very nature, parasites divert energy from their host for their own survival and reproduction. Consequently, some parasite infections can lead to debilitation of individual fish and serious disease problems within populations. Here, Chris Williams and Shaun Leonard give us a brief introduction to some of those parasites and problems.

The Fish Louse, *Argulus*

The fish louse, *Argulus*, is a resident of rivers and lakes and one of the most familiar parasites encountered by anglers. Three species have been recorded from British freshwater fish and all may be found on the skin and fins of trout. The largest is *Argulus coregoni* (Figure 2), a parasite with a preference for running water so most likely to be encountered by the wild trout angler.

Adults, up to 10mm in size, are light brown and well camouflaged on the flanks of trout; the black, beady eyespots can give them away (Figure 3). Suckers allow the parasite to move with surprising agility, yet clamp like a limpet when faced with risk of detachment.

Infections of *Argulus* in the wild are often limited to odd ones and twos, tolerated by most healthy fish. Large aggregations of fish, prolonged low flows and warm temperatures can cause parasite numbers to increase. Heavy infections can be extremely damaging, the continual feeding and attachment behaviour damaging the skin and draining the fish's energy reserves.

There are reports from the 60s and 70s of salmon and sea trout 'black with lice' during extended low flows. More recently, dry summers have led to rising abundance of

A. coregoni on brown trout in some northern rivers, although subsequent rainfall has dispersed these infections. The ubiquitous *A. foliaceus* is the scourge of stillwater trout fisheries, threatening the economic viability of some. In such cases, lice may be found in their thousands on individual fish, causing severe irritation and rapid condition loss.

The Gill Maggot, *Ergasilus sieboldi*

This parasite, first recorded in Britain in the 1960s, is most likely to be a problem for trout in lakes or gently-flowing river reaches, since it is a tiny copepod crustacean (a little over 1mm in length), unable to cope with much flow. Only the females parasitise fish, but quite spectacularly, with modified antennae gripping on whilst mouthparts rasp away at the delicate gill tissues (Figure 4).

Heavy infections undoubtedly cause fish mortalities, but thus far, the parasite has only been a problem in coarse fish communities and stocked stillwater trout fisheries. The common name, the gill maggot, derives from the appearance of attached females carrying a pair of white, elongate egg sacs, usually in the spring and summer (Figure 5).

The Fish Leeches, *Piscicola* and *Hemiclepsis*

Fish leeches are common, obvious parasites of trout, especially in stillwaters and slower river reaches, visible as a red-brown, worm-like creature up to 30mm in length, attached to the fish's skin (Figure 6).

They feed on the fish's blood, biting through the skin, holding position with a sucker at each end of the body. Heavy infestations might cause individual fish problems through loss of body fluids and leech bite wounds can become infected. Once the leeches have had their fill, they drop off and hide amongst weed and stones, digesting their meal. When hungry, a fish leech either actively swims to latch on to another host, or hangs off a piece of weed, head first, and grabs on to a fish as it swims by. Should you remove leeches from a fish that you've caught and are about to release? It will make you feel a bit better but it will probably make no difference to the fish, one way or the other!

Ulcerative Dermal Necrosis (UDN)

UDN is an interesting condition: mortalities in salmon, sea trout and rainbow trout have been attributed to it for over 100 years, yet there is no known causative agent; it is speculated (only) that it may be a virus. Classic UDN appears as shallow, open sores (almost graze-like) on the head of the fish moving from sea into freshwater and these quickly become infected with opportunistic organisms like the fluffy, white fungus *Saprolegnia (Figure 1).* This adds to the confusion, because fish without UDN can naturally contract *Saprolegnia*, especially spawning male trout and salmon whose thinned skin and propensity to fight each other makes them more vulnerable to infection. Recent research in Poland suggests that UDN-exposed brown trout are less able to maintain the internal chemistry of the body, contributing to the fish's death. Some authorities suggest that UDN proliferates where there are large numbers of fish congregating in low-flow rivers and sunny conditions but again this is not totally consistent.

Large-scale mortalities of salmon and sea trout, attributed to UDN, were reported in many UK rivers in the 1960s and 70s and problems reappear periodically. Fish health scientists do not consider UDN to be a widespread problem in the UK. However, further efforts are needed to monitor this condition and new molecular diagnostic techniques could help with finding a causative agent in the future.

The Spiny-Headed Worm, *Pomphorhynchus*

Pomphorhynchus laevis, also known as the 'orange peril', belongs to a group of parasites known as the spiny-headed worms or *Acanthocephala*.

The array of spines that cover the head of this parasite make it a master of attachment (Figure 8). During attachment, the entire head of the parasite is forced through the gut wall into the body cavity. Inflation of a bulb just beyond the neck plugs the parasite firmly in place, the body hanging free within the fish's gut. Here, the parasite absorbs nutrients from passing food and deposits its eggs that are flushed out with the faeces.

Many trout and grayling anglers will be aware how the addition of an orange spot can make shrimp patterns deadly. It may come as a surprise that such 'bling' stems from the parasite world rather than the imagination of the fly tyer. The orange spot is in fact the larva, or cystacanth of *P. laevis,* that infects the freshwater shrimp *Gammarus pulex* as an intermediate host (Figure 7).

This hot-spot makes shrimps more visible and attractive, with the aim of the parasite to be quickly ingested by a fish where it can mature. In addition to this obvious colour change, *P. laevis* also alters the behaviour of infected shrimps, over-riding many of its natural instincts. For example, unlike healthy shrimps, those infected no longer seek shelter of weed or stones, are active throughout daylight, swim higher and further in the water column and are attracted to fish odour rather than repelled. Such behavioural changes increase the chances of the shrimp becoming the next mouthful of a passing fish. This is one of many examples where parasites intricately re-wire their host to promote their own development and reproduction.

Figure 2: *Argulus coregoni* – note the large suckers for attaching to the fish's skin and numerous swimming legs.

Figure 3: *Argulus coregoni* sheltering behind the pectoral fin of a brown trout

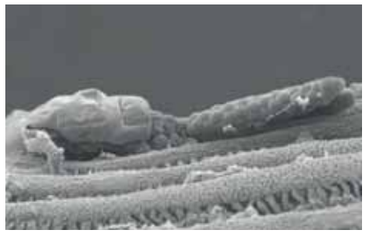

Figure 4: an electron micrograph of the gill maggot, *Ergasilus sieboldi*, on a fish's gill. Note the modified antennae gripping on to the gills!

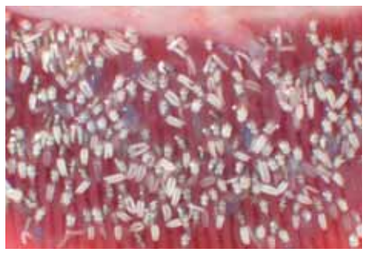

Figure 5: a heavy infection of the gill maggot, *Ergasilus sieboldi*, on a fish's gills. The egg sacs hanging from each female are very obvious and explain this parasite's common name.

Proliferative Kidney Disease

Proliferative Kidney Disease (PKD) is a serious problem in rainbow trout culture, caused by a tiny myxozoan parasite called *Tetracapsuloides bryosalmonae*. Clinical disease signs include swelling of the kidney that can lead to mortality during the summer months. In Europe, there is some evidence to suggest that PKD is increasing its distribution and severity. The disease has recently been linked to the decline of wild brown trout in Switzerland, disease of Arctic char in Iceland and also mortality in salmon parr in Norway.

For many years, the life cycle of *T. bryosalmonae* eluded scientists, hindering understanding of parasite transmission and disease dynamics. It was purely by chance that a scientist discovered the parasite within free-living freshwater bryozoans – tiny filter-feeders that grow freely on tree roots and rocks in our rivers.

The parasite responsible for PKD is widespread in the UK, but no serious disease problems have as yet been recorded in our wild trout populations. However, little is known about the impact of this parasite in the wild and how changing environmental conditions could alter disease emergence in the future. There is some concern that rising water temperatures and eutrophication could all promote the proliferation of bryozoans and the parasites within. Collaborative studies between the Environment Agency, Cefas, Aberdeen University and the Natural History Museum are underway to improve our understanding of PKD and the risks posed to wild brown trout populations.

Figure 6: the fish leech, *Piscicola*. Note the sucker at each end of the worm-like body and red colouration from blood within.

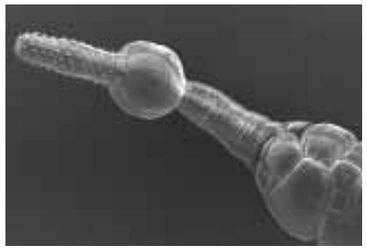

Figure 8: a microscopic close-up of the head of *Pomphorhynchus laevis* – note the proboscis of the worm lined with attachment hooks and the bulb, designed to plug the parasite firmly within the gut of an infected fish.

The Nematode Worm, *Eustrongylides*

Nematodes are common parasites of fish, but are often overlooked due to their tiny size or apparently harmless existence. But at over 40mm in length and coloured bright red, *Eustrongylides* is a conspicuous parasite that infects the body cavity of trout (Figure 9). Each parasite lies coiled within its own white, fibrous cyst, which provides protection until its host is eaten by a fish-eating bird. It is only then that the parasite becomes re-animated, attaching and maturing within the bird's gut. Death of the fish can also trigger these nematodes into life, occasionally surprising anglers when gutting or filleting their quarry.

Figure 7: the freshwater shrimp, *Gammarus pulex*, infected with the larva of a spiny-headed worm, evident as a bright orange spot.

Figure 9: cysts of *Eustrongylides* filling the abdomen of a brown trout.

As with most parasites, light infections are tolerated by trout with few adverse effects. It is only when infections proliferate that problems arise. Recent investigations have revealed unusually heavy infections of *Eustrongylides* in some UK wild brown trout populations. Affected fish appear swollen and lethargic. Such infections also cause ovary degeneration, greatly reducing their reproductive potential. Studies are underway by the Environment Agency to assess the extent and severity of these cases.

Should you encounter any disease problems in trout or require more information on the parasites mentioned, please contact the Environment Agency or Cefas.

Email: fish.health@environment-agency.gov.uk