

Ferox trout: A Predator worthy of Pursuit and Protection

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Introduction

In June 1985, a mixed group of anglers and scientists gathered on the banks of Loch Quoich in North West Scotland at the invitation of a major whisky company, seeking to promote its brand name through the capture of a new rod-caught Scottish record Brown trout. The record attempt failed, despite the capture of several large trout in excess of 5kg. However, the week-long pursuit cemented friendships and professional cooperation which have lasted until the present day. An umbrella organisation called the Ferox 85 Group was set up at the end of the attempt to further research into both the biology of our target species and also into the angling methods required to catch them. The group was so called to mark the year of our formation and also to honour the traditional name of our quarry 'Ferox', first coined by the angler-scientist Sir William Jardine in 1835. Behind our scientific curiosity and angling enthusiasm, we knew that we were dealing with an almost lost angling tradition that was once a great part of our national sporting heritage. In addition, the professional biologists within the group were aware of a huge gap in knowledge that existed in many aspects of the biology and ecology of our chosen quarry, and were determined, often against the perceived wisdom of their employers, to ensure that this gap would be narrowed. That gap has indeed been narrowed over the last twenty years of the group's existence both in our knowledge, regarding the basic biology of the fish, and in our application of specialist angling knowledge.

In so doing, we have initiated basic research ourselves and, just as importantly, cooperated with prominent scientific specialists such as Professor Andy Ferguson, Dr Niall Campbell, Dr Eric Verspoor and Dr Johan Hammar in furtherance of their own research projects. In addition, we have nurtured good relations with various branches of the media in order to inform the general public as well as the angling public of our quarry, to raise both its conservation value and its role as a natural cultural resource.

Ferox and their environment

Defining what constitutes a Ferox is still a matter of debate 170 years after the term was first used by Sir William Jardine in 1835. During that time, there has been a great deal of debate over the morphometric-meristic, genetic and ecological characteristics that may separate Ferox from other forms of Brown trout. By and large, this debate has raged and ranged over whether Ferox are just 'ordinary' Brown trout that by sheer chance reach a size where they switch over to a predominantly fish diet or whether behind this situation lies a genetic inheritance, distinct from that of other forms of trout, that determines the ecology and physiology of would-be Ferox from conception.

Modern genetic techniques have led to a recent intensification of the debate, but even two of the present authors still do not agree about whether Ferox are genetically distinct from other trout. Greer is convinced that genetic studies such as those by Ferguson (1986, 1989) and Ferguson and Taggart (1991) do indicate a distinct genetic underpinning of the Ferox phenomenon. Thorne, on the other hand, is much less convinced and believes that the case that all Ferox share a similar haplotype that separates them from other trout is not yet proven and certainly, for example, although it may be the case that Ferox in Loch Awe, Loch Laggan (Scotland) and Lough Melvin (Ireland) are of the same haplotype (Duguid *et al.*, 2006), this has not shown to be clearly the case in Loch Rannoch and Loch Garry (both Scotland).

Works such as those mentioned above and also those of Verspoor (in prep) do, however, show that there is a great deal of genetic variation in British, Scandinavian and Irish Brown trout indicative of multiple, post-glacial invasions of genetically distinct groups of Brown trout and that these may occur both sympatrically and allopatrically, depending on post-glacial access opportunities. If an all-embracing clear definition of a Ferox still awaits realisation, then the next best option is a working definition for the time being. Campbell (1979) and Greer (1995) proffered this as a definition: 'Ferox are long-lived, late-maturing, piscivorous Brown trout (*Salmo trutta* L. species complex), which in Britain and Ireland, are often present in large, deep glacier-formed lakes containing Arctic charr (*Salvelinus alpinus* (L.)) or whitefish (*Coregonus* spp.). Berkenhout (1789), however, gives a beautifully terse account that still largely rings true more than 200 years later: 'Lake Trout; sometimes fifty or sixty pounds: in the North'.

The Ferox environment is generally described as lakes of the montane, alpine and sub-Arctic zones of the Western Palaearctic and they can be found in such lakes, west of the Urals, from Kerry in Ireland to the Kola Peninsula in western Russia. In most of the Caledonide mountain range of Fennoscandia, Scotland, and Ireland, they occur in deep (up to 300m) glacial-ribbon lakes of simple basin morphometry, of oligotrophic status and with a relatively simple complex of prey species consisting mainly of other comparatively stenothermal boreo-arctic fish. Campbell (1979) indicated that, in

Scotland, Ferox are mainly found in lakes of over 100ha with a population of Arctic charr. However, Ferox do occasionally occur in smaller lochs such as the 20ha Loch Bhrotain, in the Gaick district of Inverness-shire.



Figure 1 : Brian Rutland (left) and David Greenwood (right) with the British rod caught record trout weighing 14.4 kg (31 lb, 12 oz) caught by Brian in Loch Awe, March 15, 2002. (Courtesy of the Ferox 85 Group.)

Ferox and their prey

In Britain and Ireland, the range of potential prey species available to Ferox is much narrower than in Scandinavia and mainland Europe. The main factor behind this is that part of the deglaciation process led to a comparatively early marine transgression, isolating Britain and Ireland as islands and thus curtailing ongoing re-colonisation by stenohaline species. However, we also have to take into account the species composition of any glacial refugial areas near to Britain and Ireland, which may always have been a simple one in any case. In most of the Ferox waters of Britain and Ireland, it has long been considered that Arctic charr (*Salvelinus alpinus* (L.)) are the main prey of Ferox trout yet strangely not until Campbell (1979) was any scientific record available from Scottish waters. Some of this information was made available to Campbell from the catches of the Ferox 85 Group and ongoing records have confirmed the importance of charr in the stomach contents of Ferox. However, a range of other food items have been found, including Brown trout (*Salmo trutta* L.) small mammals (*Microtus* spp.) and European perch (*Perca fluviatilis* L.). A large (14kg) Ferox from Loch Awe contained a perch of 24 cms in length (Rutland, pers. comm., 2005). Data presented by Campbell (1979) and Greer (1995) showed prey size selection from Ferox stomachs suggesting a preferred prey size of a fish of around 30% of the length of the predator and a maximum prey length of around 50% of body length.

Extensive studies in Scandinavian Ferox waters e.g. Taugbøl *et al.* (1989) and Skurdal *et al.* (1994) have thrown even greater light on the diet of Ferox. The prey species range comprises a wider variety of fish species, including Smelt (*Osmerus eperlanus* L.), than is natively resident in British and Irish freshwaters. This information confirms that in waters with a medium density of prey fish (100-200 fish per hectare), there is a prey size selection consistent with that found in Scottish lochs, but indicates that where prey abundance is greater than 200-300 fish per hectare, that prey size selection is less likely to happen due to a large abundance of small fish making it possible for Ferox to meet their energy and protein requirements from this source.

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waters. Apart from the intrinsic value of these Scandinavian studies, they could give an important insight not only in respect of the relationship between Ferox and their native prey species in Britain and Ireland, but also into the changing situation brought about by introductions of exotic species such as Roach (*Rutilus rutilus* L.) into Lough Corrib (Ireland) and Loch Tay (Scotland).

Aass (1994) found that in stocking trials in Lake Mjøsa (Norway), Ferox trout of Lake Tunhovd origin performed less well than native Ferox trout from the River Hunder, a major tributary. He concluded that this was due to different behavioural traits in the trout origins. Reciprocal studies in this lake, and in others, suggested that Ferox derived from provenances adapted to hunting pelagic prey fish, such as Smelt (*Osmerus eperlanus* L.) and Whitefish (*Coregonus* spp.), outperformed those derived from lakes where the prey fish were semi-benthic charr when transferred to lakes dominated by pelagic prey fish. In contrast, Ferox derived from the pelagically-adapted Mjøsa trout performed poorly when transferred to montane charr lakes. The inference here is that such behavioural traits are genetically determined. If this is the case, then Ferox populations may be negatively affected if the prey fish species complex in any given lake is changed by anthropogenic introductions of exotic species. Igoe (pers. comm., 2003) and Kettlewhite (pers. comm., 1996) suggested that the Ferox of Lough Corrib have successfully switched from charr to roach as a prey base, following the extinction of the former after the introduction of the latter. However, so little is known about detailed interactions between Ferox and various permutations of possible prey species, that we should be cautious of using this situation in a generally predictive manner.

Ferox and their foraging strategy

The manner in which Ferox hunt their prey has been a major question for both angler and scientist alike for almost two centuries. The great Ferox-angling sages of the Victorian and Edwardian eras, such as Sir John Colqhoun of Luss, T. Speedie, and T.T. Stoddart, made much comment on specific sites, depths, times of day, times of year and techniques most likely for an angler to encounter an actively feeding Ferox. However great their experience and intuitive their insights, there was no definitive information regarding whether Ferox behaved like an ambush predator or were active free-ranging pursuit predators.

Recent research carried out by Ferox 85 Group members and staff of the FRS Laboratory (MacDonald and Thorne, 2000; Thorne *et al.*, 1994-2006; Thorne *et al.*, in press) has given fresh insight into the horizontal and, to some extent, vertical movements in Loch Garry and Loch Rannoch (Perthshire) using radio, acoustic and data storage tags. This has indicated that Ferox do not have a home range, *per se*, and indeed make wide ranging horizontal movements throughout the day. Although spending much of their time in water less than 10 metres deep, Ferox were recorded making dives during the day down to depths up to 30 metres, presumably to capture Arctic charr. They became less active at night and moved closer to shore. The implication is that Ferox are active pursuit predators and not ambush predators using preferred cover to attack passing prey. Further indications of the wide ranging movements came from a tag-and-release trial in nearby Loch Rannoch where one fish was recaptured over 6km from its original capture site, just 19 days after capture. Several other fish had covered distances of 2-4km from their original capture site. This information has of course practical value for the specialist angler, but also has profound implications for the energy balance of both individual fish and the Ferox population as a whole.

Ferox growth and longevity

The classic definitive growth pattern of Ferox has been described by Campbell (1979) and Greer (1995). The main features are a period of initially slow growth followed by a startling increase after a switch of diet from invertebrates to fish, normally when the fish reaches a length of 30-35cm. Thereafter, Ferox in Scotland have in modern times been recorded as reaching weights up to 14.4kg (Loch Awe 2003 British rod-caught record) and a fish of almost 15kg was caught and released alive the following year by the same angler (Rutland pers. comm., 2005). This is, however, well within the historical size records from Britain, Ireland and Scandinavia summarised by Campbell (1979) and Greer (1995) where several Ferox over 20kg were mentioned. Growth and longevity data from Loch Awe suggests that it is not unlikely that Ferox over 20kg will exist in this water.

Direct evidence of the rapidity of Ferox growth was exemplified in the above-mentioned tagging study. Thorne and MacDonald (2003) recorded a fish that was captured in 1994 at a length of 52cm and a weight of 1.6kg and recaptured in 1998 at a length of 77.5cm and a weight of 6.4kg. The current rod-caught record at 14.4kg was a fish of 11 years of age.

The oldest known Ferox from Loch Garry, Perthshire, was a fish of 17 years (Hynd, pers. comm., 1976). In Loch Rannoch, Thorne (2006) reported a multiple-recaptured tagged fish of 18 years of age. The oldest known trout from a Scottish loch is a Ferox of 23 years of age taken from Loch Killin in Inverness-shire.

The future for Ferox: utilisation and protection

There is no doubt, from the extensive angling literature, that in the Victorian and Edwardian periods, Ferox were an iconic sporting quarry that were a core part of the itinerary of gentlemen angler-scientists like Jardine, Colqhoun, Malloch and others visiting the great lochs of the Scottish Highlands and Ireland. Ferox angling no doubt created jobs for ghillies,

servants and tackle manufacturers, all in some way impacting positively on socio-economic activity in upland areas bereft of alternatives. This tradition failed to maintain itself into the second half of the 20th Century in the way that salmon fishing and grouse shooting did and was only continued by a relatively small number of individuals. Additionally, until the classic paper by Campbell (1979), there was little scientific interest in the study of this form of Brown trout.

This situation has changed dramatically in the last 15 years with general public awareness of Ferox, specialist angling and scientific interest greatly increased. The activities of the Ferox 85 Group have been a central part of this increased interest. This has been brought about by several main factors: the capture of several new rod-caught records by group members, together with several more near-record catches, the involvement of the group in a number of TV and radio programmes, the publication of a popular scientific book on Ferox and several press articles by a group member, and the initiation of several research projects by the group, together with cooperation with British and Irish scientists in other studies.

It is difficult to quantify the overall effect, but an indication may be gleaned from the fact that that in 1993, the Ferox 85 Group were the only specialist anglers fishing the Pass of Brander section of Loch Awe in March, whilst in 2003, 16 boats targeting Ferox were out from dawn on opening day (15th March). Further anecdotal information gained by the Ferox 85 Group, in recent years, strongly suggests a growing interest in angling for Ferox. This does not indicate mass participant sport status as yet, but the technical and physical requirements inherent in specialist Ferox angling require a high individual spend per angler in terms of tackle, travel, accommodation and subsistence. All of this may have very important and beneficial local effects in the rural economy.

The subjective impression is that, in recent years, there has developed more angling pressure on Ferox than at any time since the Victorian period, not only in terms of angler numbers, but also in their technical efficacy. No definitive population estimates for any Ferox population in Britain or Ireland are known to the authors, but the indication from the tagging study at Rannoch and others in Scandinavia strongly indicates that overall numbers in any given water may be comparatively low and therefore very vulnerable to over-exploitation. The critical population size for the maintenance of any given Ferox population is not as yet known. In Scotland, there is a growing trend for a catch-and-release approach amongst Ferox angling. The studies of the Ferox 85 Group in Lochs Garry and Rannoch clearly indicate that, with careful handling, Ferox can not only survive repeat capture on robust tackle, but continue to thrive and reach large sizes. Therefore, the implementation of a catch-and-release policy will be an important measure for protecting Ferox from over-exploitation by angling.



Figure 2: A fully rigged boat ready to be used by the Ferox 85 group on Loch Ericht. (Courtesy of the Ferox 85 Group.)

However, increased angling pressure on Ferox trout is only one of a number of other threats to their continued survival and perhaps not even the greatest one. The Nordic seminar on the Management of Ferox Report (1992-1994) highlighted a number of biotic and abiotic threats to their continued well-being. Whilst Scotland and Ireland do not have the threat of widespread traditional gill-net fisheries to contend with, most of the other threats highlighted by the Nordic report are common to both countries in varying degrees. In Ireland there is a comparatively greater threat from water abstraction and eutrophication, affecting habitat quality, than there is in Highland Scotland, but a common threat in both countries is the continuing anthropogenic spread of exotic fish species. Both countries also have had concerns about the impact of commercial forestry in upland areas hosting Ferox spawning streams. Hydro-electric regulation has been a major factor in altering many aspects of the physical and biological environment of lakes in Scandinavia e.g. Aass (1973, 1984), Grimås (1961) and Nilsson (1961, 1963). These effects are generally negative on food production and can seriously impact on both inflow and outflow spawning areas for Ferox. Unlike Scandinavia, Scotland is without the classic before-and-after studies carried out in Scandinavian hydro-electric schemes, but there are obvious analogies especially in the typical development of eroded draw-down zones, bereft of macrophytic vegetation. There is a fairly good *a priori* case that the outflow dams on Rannoch and Awe may have negatively impacted on Ferox recruitment (Greer, 1995), but definitive research still needs to be carried out. Ferox and man have co-existed in Britain and Ireland for at least 18,000 years. Just at a time when Ferox are once again achieving the status of a sporting icon important for cultural tourism, there are a number of imminent biotic and abiotic threats to their continued survival. Anglers and scientists should unite in bringing their importance and that of the environment that supports them to the ever closer attention of politicians and administrators responsible for proposing and enacting protective measures.

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