



## Arctic charr populations in NW Scotland (and other areas): their conservation and management requirements

*Report of a workshop at the Loch Maree Hotel on  
27 November 2008*

supported by Wester Ross Fisheries Trust, the Scottish Government (via RAFTS) and SNH.



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### 1. Introduction

The Arctic charr (*Salvelinus alpinus*) has recently been added to the UK LBAP 'Priority species list' and to the Scottish Biodiversity Strategy list of priority species. It's fair to say that few people, including anglers, pay much attention to charr, largely out of ignorance. Charr are rarely caught, rarely seen; perhaps readily overlooked by some of those involved with managing the systems which support our major salmon and trout fisheries.

As part of the WRFT Arctic charr discovery week 2008 programme of activities, a workshop aimed primarily at Fishery Trust biologists took place at the Loch Maree Hotel. The overarching aim of the workshop was to provide an opportunity for reviewing action points with regard to Arctic charr for RAFTS Fisheries Management Plans, currently in preparation. [Please contact WRFT for information about other activities during the week, including the sampling programme.]

The workshop was attended by Prof Peter Maitland (Fish Conservation Centre [FCC]), Alex Lyle (ALP), Dr Colin Adams (Glasgow University), Dr Colin Bean (SNH), Dr Eric Verspoor (FRS), Ron Greer, Simon McKelvie (Conon DFFB), Lynn Brydon (Conon DSFB), Keith Williams (Ness and Beaulie Fisheries Trust), Peter Cunningham (WRFT), Jim Raffell (FRS Shieldaig project), Mary Gibson (SNH), Angus Tree (SNH), Fergus MacKenzie (Gairloch Angling Club), Mark Vincent (Loch Maree Hotel). Apologies were received from Alan Kettlewhyte (Argyll Fisheries Trust), Dr Shona Marshall (WSFT); and Diane Baum and Lucy Smith (Lochaber Fisheries Trust).

The workshop was informally organised into sessions on distribution, biodiversity conservation and assessment; with a practical session by the loch-side to set nets and learn about loch habitat surveying using an ROV, and an indoor session to review sampling methodology and action points for FMPs. Presentations were given by Prof Peter Maitland, Dr Eric Verspoor, Dr Colin Adams and Dr Colin Bean: summaries of these presentations are given below.

This report has been drafted from notes made during the workshop. **For those who were at the workshop, please add / amend as required.** Action points can be adapted for other fishery trust FMPs.



## 2. Arctic charr distribution in Scotland and the FCC Charr database

**Prof Peter Maitland** described how the Arctic charr *Salvelinus alpinus* has a circum-polar distribution, and is found in river systems in all continents. To the south of the Arctic Circle, there are many landlocked populations, especially in the lakes of Norway, Finland, and Canada.

The species is highly variable, and different populations exhibit different morphological characteristics. Taxonomists still debate whether they should all be treated as a single species. <sup>1</sup>Kottelat recently proposed that different populations, for example the two 'sympatric' populations in Loch Maree (see below), should be regarded as distinct species. This interpretation is not widely accepted by other charr biologists (including those present at the workshop!). However, all recognise that there is remarkable biodiversity within the species.

Hardy 1940's '*Ferox and charr*' provides a good initial description of the occurrence of charr in Scotland. One of the first scientists to investigate Scottish charr was Kim Friend, a lecturer at Edinburgh University. Using cotton nets, he collected charr from many lochs and his collection of 40 -50 charr is kept at the Royal Museum of Scotland. Niall Campbell, one of Friend's students, continued to build up records of charr in Scotland. Maitland, Greer, Campbell and Friend (1984) is one of the first detailed summaries of charr distribution in Scotland and this paper led to the development of the database.

The FCC database provides grid references of all lochs where charr have been recorded in Scotland, together with notes on the lochs and the source of the record. In addition, for each loch a list of publications relating to respective charr populations has been compiled. The database needs to be updated, and could be housed at the Scottish Fish Conservation Centre. This raises questions regarding access to data and its availability to other parties.

There is still incomplete knowledge of charr distribution in Scotland. An initial objective for FMPs could be to **survey lochs on a catchment by catchment basis**: which river catchments with lochs have charr populations and which do not? For example, in the WRFT area, charr have not been recorded in the Ullapool River or Broom catchment despite the existence of apparently suitable lochs.

One of the most interesting aspects of charr occurrence in Scotland is the **occurrence of polymorphic populations**. Within the WRFT area, two forms of charr are known in Loch Maree, and from studies by Verspoor and Greer 2008, now also Loch Doughaill (River Carron), and possibly also Loch na Sealga (Gruinard). Lochs with polymorphic populations tend to be over 50ha in area.

- **Proposed action:** confirm presence / absence of charr in lochs in river systems on a catchment by catchment basis (e.g. for WRFT area within lochs in the catchment of Kanaird, Ullapool, Broom, Ling and Elchaig).
- **Proposed action:** investigate whether there are other lochs with two or more distinct morphs (sympatric populations) of charr.

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<sup>1</sup> **Maurice Kottelat & Jörg Freyhof. 2007. Handbook of European Freshwater Fishes.** Published by the authors. ISBN 978-2-8399-0298-4, 2007, xiv+646 pp., 17.5 x 26 cm 87.00 Euro. Available from [publications\\_kottelat@bluewin.ch](mailto:publications_kottelat@bluewin.ch)

### **3. Trout lochs, (charr lochs) and fishless lochs.**

In a useful divergence from theme, Colin Adams drew attention to a report funded by SNH, which considered the biodiversity and conservation priorities for all lochs and lochans including those without fish populations [ref . . . ].

Participants at the workshop re-stated the value of lochs without fish. Where fish are not present, invertebrates thrive and in some fishless lochs and lochans, the Palmate newt is top predator. Fishless lochs tend to be undervalued, and may be seen by anglers as vacant 'niches' for fish. There is a need to catalogue such waters.

PC described how the practice of moving trout into lochs which may not be able to support a self-sustaining wild trout population was widespread within the WRFT area and had probably been going on for many years. Some of the largest, most desirable trout were produced by such introduction: hence the inherent secrecy! PC asked whether there was evidence of long-term damage to other biota as a result of such movements? PC asked whether, in principle, there was any difference between stocking trout into a loch or lochan from stocking sheep or cattle onto a hill.

PC also asked whether it would be possible to designate lochs and lochans according to whether they had been 'managed' in the past (e.g. accessible lochs and lochans in most crofting areas) or not (e.g. remote lochs and lochans where less likely / frequent introductions of trout). Are there objective ways of assessing the conservation value of a fishless loch, for example the occurrence of sensitive taxa?

#### **Proposed / possible actions:**

- Survey all lochs and lochans to find out which support fish populations and which do not. Compile results onto GIS compatible data base.
- Identify lochs where trout populations may be of anthropogenic origin.
- Extend awareness and knowledge of new legislation which makes it illegal to move fish from one loch to another.
- Ask the Scottish Government to produce a leaflet for anglers outlining the new legislation and why it has been developed.
- Extend awareness of the value of fishless lochs to support other wildlife for example, invertebrates, newts, and breeding ducks (e.g. Common scoter).
- Develop networks of priority lochs for conservation where stocking of trout or other fish should not be permitted.
- Conversely, accept that in some areas (e.g. crofting lands) there may be lochs and lochans which are naturally fishless but have a long history / cultural tradition of being managed informally through transfer of trout from nearby waters, and therefore may be considered as 'managed' waters.

#### 4. Charr biodiversity, evolution and conservation

Colin Adams then described how morphological variation between charr populations makes them of particular interest to those studying the dynamics of evolution. Colin has many excellent slides / posters with photographs of charr from lochs around Scotland to highlight morphological variation. Charr are in many ways analogous to Darwin's finches in the way they have become adapted in response to the environmental pressures of 'niches' in the lochs they inhabit. Unlike Brown trout, charr have not been moved about in Scotland to any great extent. Populations of Scottish charr, even compared to those in other countries, remain relatively undisturbed and are therefore of great value for studies of evolution.

For charr, genetic studies (summarised by Eric Verspoor) have focussed upon Mitochondrial DNA [mtDNA]. MtDNA haplotypes represent distinct maternal lineages. The numbers of different haplotypes so far recorded in Scotland are very similar for Brown trout, Atlantic salmon and Arctic charr (18, 18, and 19 respectively). [?for trout populations] In one loch there can be as much haplotype diversity as for the whole of Europe.

Two major groups of charr are found in Scotland: 'east type' and 'west type'. 'East type' charr populations are found in lochs draining into river systems which drain into the North Sea. 'West type' charr populations are found in Lochs in river systems which drain towards the Atlantic. So far, all charr populations from WRFT lochs (Loch na Sealga, Loch Maree, Loch Dughail, Loch Damph) as expected, are 'west type' charr.

Elsewhere in Scotland, Loch Rannoch is of particular interest: three sympatric charr populations have been recognised, including both 'east' and 'west type' charr, suggesting colonisation by charr from both directions as the glaciers retreated 10,000+ years ago.

Very often benthic charr populations are big-eyed with down-turned mouths. Such features are obvious adaptations to feeding on the bottom of lochs in low light. Loch Laidon is of interest: there are no charr but two distinct trout populations, one of which is benthic and of similar morphology to a typical benthic charr population.

#### Points for FMPs:

- Populations rather than species should be targeted for conservation.
- An understanding of charr biodiversity and how it has evolved can also help inform and guide brown trout and salmon conservation.
- A primary management aim for charr populations should be **to maintain conservation status** of populations . . . (This assumes some knowledge of respective charr populations which, for almost all in WRFT area, is lacking . . . see subsequent presentation by Colin Bean)

## 5. Assessment of charr populations

Colin Bean presented a summary of a study to develop assessment methods for charr populations in Scotland<sup>2</sup>. The aim of the study, supported by SNH, was to develop a protocol for assessing charr populations in Scottish lochs. Five lochs were selected for assessment from Orkney to Galloway: Lochs Builg, Doon, Eck, Girsta and Inch.

Of a range of methods tested, the protocol developed combined hydro-acoustic surveying (to assess the sizes and abundance of fish per unit area and volume) with gill netting. Colin stressed the importance of carrying out gill netting at the time of the hydro-acoustic survey to establish the identity of the fish recorded by the hydro-acoustic survey. Gill netting after the survey was of less value as fish movements would make interpretation of hydro-acoustic data less certain.

Having developed the most efficient means of assessment, the study evaluated charr populations in each of the 5 lochs. Of charr populations in each of the five lochs, 3 passed the initial assessment (Builg, Inch and Girsta) and two failed (Doon and Eck). A second round of charr population assessments is currently underway.

The hydro-acoustic equipment required for the above is expensive and requires relatively complex data processing. However, AL suggested that significant information on fish can be gained using smaller, less expensive equipment. Also, this can be portable and carried to hill lochans.

It is important to carry out transects during the day and by night to gain an adequate understanding of fish abundance. There are problems in interpreting very small fish (e.g. juvenile charr which can be mistaken for cladocera).

Aging charr: scale reading is not as straightforward as with trout and salmon, especially for older charr. Use of otoliths is recommended as otoliths continue to grow.

### Proposed actions (for loch fish surveys in general)

- a training workshop charr / loch survey protocol would be of value to fisheries trust biologists. The SFCC may be best able to develop the protocol and training.
- For 'high priority' lochs (?e.g. Loch Maree): Hydro-acoustic - gill netting assessment once every 5 years.
- For lochs where the presence of charr is uncertain, exploratory gill netting.
- To confirm charr in other lochs, gill netting once every 10 years . . . ??
- A RAFTS Lochs Working group could help to identify and develop collaborative surveys and management projects.
- A RAFTS / SFCC workshop on otoliths and using them to age fish.

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<sup>2</sup> Ian J. Winfield, Janice M. Fletcher, J. Ben James and Colin W. Bean (2008) **Assessment of fish populations in still waters using hydroacoustics and survey gill netting: Experiences with Arctic charr (*Salvelinus alpinus*) in the UK Fisheries Research, In Press, Corrected Proof, Available online 5 September 2008, [View Abstract](#)**

## Arctic charr as a fisheries resource in Wester Ross

This discussion occurred a little earlier in the workshop but fits here!

Participants considered charr fisheries. The Windermere charr fishery is the best known in the UK. Over-fishing of charr on their spawning ground is believed to have led to the extinction of the St Mary's Loch charr population. In Wester Ross, Dixon (1885) describes how [in the 19<sup>th</sup> century] Lord Seaforth used to net charr in Loch Maree each year during the late autumn. RG said that ?Charles Maclaren could catch many charr on the fly in a single night in Loch Maree in the 1970s.

- **Action:** WRFT should not promote charr angling within the area. Anyone else who wishes to promote charr angling should first assess the conservation status of the charr population and be able to demonstrate that the population is in good health (unless catch and release is adopted). .
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## 6. Charr management recommendations

The workshop did not progress as far as making loch-specific recommendations for charr management. However, some general agreement was reached on recommendations for actions based on Simon McKelvie's Conon FMP:

### Suggested aims:

- To maintain the distribution of charr within area
- To maintain favourable status of charr populations within area

### Suggested actions

- To catalogue information about charr occurrence in the area
- To develop an anglers log-book / reporting scheme to record charr.
- To develop survey protocols for charr.

Participants also agreed that at the national level, the SFCC could play a useful role, particularly in housing and updating the FCC database. SM was going to raise this at the next SFCC meeting.

