FEARNA STORAGE

Fearna Pumped Storage Hydro Scheme
EIA Report

Appendix 11.4 – Prof. Colin Adams – Summary of Conclusions

February 2025

Quality Information

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Appendix 11.4

Loch Fearna Pumped Storage Hydroscheme:

Summary of the status and mitigation of impact upon Arctic charr

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22ndth February 2025.

Background

This short note provides a view on the proposed Fearna/Quoich Pumped Storage Hydro scheme in relation to the Arctic charr, *Salvelinus alpinus*. This view has been informed by a review of the documents listed in Appendix 1 and my specialist knowledge of this species. I address three principal questions:

1. What is the status of Arctic charr in the development area?
2. What are the major potential impacts upon that species?
3. Which mitigation is the most likely to be appropriate for this species at this site?

The status of Arctic charr in the development area?

There are records of Arctic charr in the development area. Most important in the context of the proposed pumped storage development are Loch Quoich and Loch Fearna.

There are robust records of charr collections (from scientists) in Loch Quoich up until the mid 1990s. To the best of my knowledge there has been no attempts at specimen collection since then. However, a survey using eDNA detected the presence of charr in Loch Quoich in 2018 although some additional eDNA sampling in 2023 was inconclusive for the presence of charr.

There are no records of Arctic charr having been collected from Loch Fearna, nor are there any informal angling reports or sightings of this species from this loch. Water samples taken from Loch Fearna for eDNA analysis in 2023 did not detect Arctic charr there, despite a relatively robust sampling strategy.

Taken together, the evidence strongly points to the absence of an Arctic charr population in Loch Fearna but an extant population in Loch Quoich.

There are a number of population characteristics that may have a bearing upon proposed development impacts on Arctic charr in Loch Quoich.

Population size: there are no robust data on the size of the charr population in Loch Quoich. Although highly speculative, the absence of a clear detection of charr in eDNA sampling in 2023 taken in the context of other evidence that the population is extant, might indicate that the population size is small.

Spawning behaviour: the Arctic charr in Scotland is primarily a lake dwelling species, but there are a small number of records of river use by the species. These mostly comprise records of charr using flowing water for spawning. At sites where river spawning is recorded, it is likely that only a small proportion of all spawning in any year occurs in inflowing rivers. There are multiple records of charr detected downstream of Loch Quoich in the outflowing river, the Gearr Garry, downstream of the Quoich Dam. It has previously been assumed that these are of charr that have been entrained in outflow water from Loch Quoich. Since the construction of the Quoich Dam, the return of charr from the Gearr Garry to Loch Quoich is not possible. There are no records of charr from waters flowing into Loch Quoich. Thus although it is impossible to be unequivocal with the data available, the probability is that the charr of Loch Quoich spawn in the lake littoral zone; the most commonly used habitat for spawning by charr in Scotland.

The habitat type required for successful spawning comprises washed gravel to cobble substrate sizes, free from high levels of small silt particles (which result in egg suffocation). Spawning time varies between populations in this species and between years. The timing of spawning has never been determined for the Loch Quoich population but the vast majority of populations in Scotland spawn between mid September and early November, with eggs (and newly hatched alevins) incubating in the benthic substrate until around April.

Multiple morphs: In a number of sites across the range of this species, multiple morphs inhabiting the same lake have been detected. Most frequently this takes the form of genetically and ecologically distinct groups that occupy alternative foraging niches, usually exhibiting as plankton feeding and a macrobenthic invertebrate feeding morphs. There are a number of places where this occurs in Scotland (for example, Lochs Rannoch, Awe, Dughail & Ericht). Where multiple morphs do occur, they are of particular scientific and conservation value. It is not known from currently available data if there are two or more morphs at the Loch Quoich site. Morphs cannot be detected using the eDNA techniques used to identify species presence. Identifying morphs would require traditional destructive sampling and a relatively large sample. Gill netting being the only realistic methodology for this site. In my view, an effective assessment of the potential for impact of this development on the Arctic charr population can be made by assuming that plankton and macrobenthos feeding charr are to be found at this site.

What are the major potential impacts upon Arctic charr?

Chapter 11 of the EIAR identifies the potential impacts of the development to Arctic charr. **During the Construction Phase** (Table 11.13) there are three potential impacts identified as potentially significant.

De-watering: the identified impact with the greatest potential effect upon the Arctic charr population in Loch Quoich during construction is dewatering. The risk from this effect is that dewatering during the egg incubation period has the potential to result in developing eggs laid in the shallow littoral zone becoming dry and thus dying.
Mitigation of this effect is simply achieved by only dewatering outside the sensitive period of the year from October to late April. If this mitigation is in place, then my view is that this effect can be avoided.

Water quality: the effects of run-off and dust deposition may impact water quality. This has the potential to result in low water quality and possibly sediment deposition (from dust). This effect is likely to be geographically localised to the construction zone. Outside the spawning

and incubation season (which is mid September to April) this effect will be negligible on plankton feeding charr (which will be in the open water of the loch pelagic zone) and small for littoral macrobenthos feeding charr, as the affected area will comprise a small proportion of the total littoral area.
Mitigation of this effect – is achieved by rigorous pollution control measures during construction. If this mitigation is in place then my view is that this effect can be reduced to negligible.

Quarrying: the effects of run-off and the introduction of sediments to the loch as the result of quarrying. This has the potential to create poor water quality in the littoral zone as the result of the introduction of sediment. Outside the spawning and incubation season this effect will be negligible on plankton feeding charr (which will be in the open water of the loch pelagic zone) and small for littoral macrobenthos feeding charr, as the affected area will comprise a small proportion of the total littoral area.
Mitigation of this effect – is achieved by rigorous pollution control measures during quarrying. If this mitigation is in place then my view is that this effect can be reduced to negligible.

During the Operational Phase (Table 11.14) there is one identified potential major impact for which additional comment may be informative.

Water level fluctuations: the most important potential effect of this would be to expose Arctic charr eggs, deposited in the littoral zone, to air, resulting in mortality. Effects on charr of water level fluctuations outside the spawning and incubation period (September to April) are likely comparatively inconsequential.

The water level fluctuations in Loch Quoich that result from the combination of the operation of the conventional hydro generation scheme there and natural variation in hydrological conditions, have been examined during spawning and incubation periods from between 2016 and 2024*. These data show that in five of the eight years, water levels fell between the likely spawning period and end of the incubation period, potentially stranding eggs. The maximum decline in water level between these periods was 5.5 m and the lowest was 0.77m. In the remaining three years, water levels were higher during the incubation period than during the spawning period (range 0.2 m to 0.81m). These range fluctuations are all well within the operating constraints of the current conventional hydro scheme of 26 m. As charr in Loch Quoich are likely to spawn in the depth range of 1 to 10 m, it is probable that in four of the years when water levels declined, there was a negative effect on spawning success resulting from egg mortality. In years when the decline was less than 1 m, or there was water level rise, egg stranding was unlikely to be a source of mortality.

N.B. * Loch Quoich's existing hydro scheme's operational regime was changed in 2015/16. Maximum winter water levels in Loch Quoich were typically higher prior to winter 2015/16.

The operation of the proposed pumped-storage scheme has the potential to superimpose a shorter duration (hours to days) frequency water level change on top of the longer term existing pattern of change. The maximum water level change resulting from the proposed operation of the pump-storage scheme is 3.2 m within 24 hours. If, as is likely, a drawdown of this magnitude occurs during the egg incubation period, then there is the likelihood of egg stranding. Hindcasting this effect to years for which there are data (from 2016 to 2024) a 3.2 m drawdown would likely impact all years; that is both in years where there was an increase in water level between egg laying and incubation (because the water level rise is relatively modest (<1m)) and in years where there was a water level decline. In none of these years (2016 to 2024) would it be likely that all eggs in the spawning area were stranded and lost, but in some years a reasonably high proportion might be.

Mitigation of this effect – one route to mitigating this effect would be to create high quality artificial spawning areas in deeper water beyond the drawdown depth of the combination effect of the pump storage operation [Fearna PSH] and the conventional generation [existing Quoich hydro scheme]. In addition to simply mitigating the effect of the pump storage it is highly likely that a well conceived mitigation plan would result in an environmental net gain, compared with the current position for Arctic charr.

Given the likely depth that artificial spawning habitat would need to be placed at, these areas will need a mechanism to enable flushing of the substrate of the very small particle size silts that are most damaging for successful spawning. Flushing could comprise either a permanently located sub-bed water jet system that will allow for periodic substrate flushing from a shore based pump system, or a vessel mounted vacuum dredger that will access the spawning areas during low water levels to remove silts by light suction.

The advantage of this mitigation is that it will provide optimal spawning and incubation substrates at a depth below the drawdown zone.

The negative element of this as a mitigation is that it is likely that a proportion of the population may continue to spawn in good quality spawning areas that are within the likely drawdown zone and thus are subsequently exposed to air. However surveys of the quality of spawning habitat (albeit geographically limited) indicate that there is currently a shortage of good spawning habitat. As a result, the provision of artificial habitat combined with a robust management regime to ensure its enduring quality, is very likely to attract charr to use these optimal spawning sites in preference to sub-optimal (semi) natural ones.

Potential additional impacts

Access to river spawning habitats: we do not have any evidence that Arctic charr from the Loch Quoich population are spawning in inflowing rivers. Although less likely, assuming that there is some river spawning by Arctic charr allows for a potential mitigation to be identified. Simply providing physical access for salmonid fishes from Loch Quoich to the inflowing waters would mitigate against any lack of connectivity between habitats.

Appendix 1

Appendix 1 a list of documents reviewed provided by Gavia Environmental.

- Ness District Salmon Fishery Board Consultation Response
- A Briefing Note to SEPA and NDSFB – Fearna PSH Briefing Document
- NDSFB Response to Briefing Note
- Gavia Environmental eDNA report University of Glasgow [Appendix 11.1.1]
- EIAR Fearna PSH – Chapter 2 The Proposed Development Issue 31.7
- EIAR Fearna PSH – Chapter 11 Aquatic Ecology v0.3
- EIAR Appendix 11.1 Fearna Aquatic Ecology Surveys
- EIAR – 11.2 Southern Access Route Aquatic Ecology Surveys
- Loch Quoich weekly average water levels during charr spawning 2016 to 2024
- Loch Quoich Level Data 30.10.24 Weekly Analysis